MACHINERY

Design—Construction—Operation

Volume 42 **NOVEMBER, 1935** **Number 3**

Electric Drives Facilitate Machine Tool Operation **is the title of an article to be published in December MACHINERY that will deal with the high degree of flexibility in the operation of machine tools obtainable by the application of improved electric motors and electrical controls.** ***The Increasing Use of Resistance Welding*** **will also be dealt with in a comprehensive manner.**

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MACHINERY

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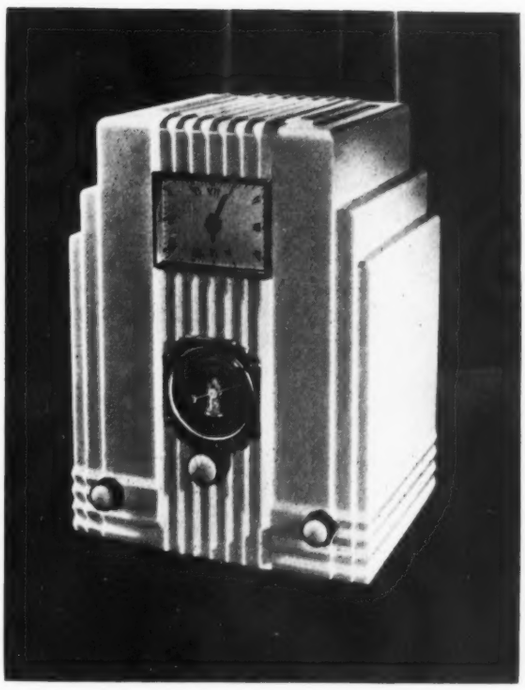
Plaskon
A New Plastic Material

DURING recent years, the synthetic plastic materials have become increasingly important. Research and experimentation are constantly being carried on with a view to perfecting those already known and developing others still more useful or attractive. Among the recently developed plastics the one designated "Plaskon" is rapidly becoming well known in industry.

Plaskon was originally developed at the Mellon Institute of Industrial Research at the University of Pittsburgh. The experiments were conducted on behalf of the Toledo Scale Co., and the material is now being made by the Toledo Synthetic Products, Inc., Toledo, Ohio.

This new material is one of the urea compounds. It is a heat-hardening plastic for hot-molding, compounded from nitrogenous resins, fillers, pigments, mold lubricants, and softening agents. In its original form, it is as clear as water and colorless: through the use of a colorless filler, pure white materials can be produced from it, as well as every conceivable translucent pastel shade. A high polish on the surface of the moldings is a characteristic of this type of material, due to its high index of refraction. The absence of phenol in its manufacture has eliminated any odor that might be found objectionable in many applications of synthetic plastic materials.

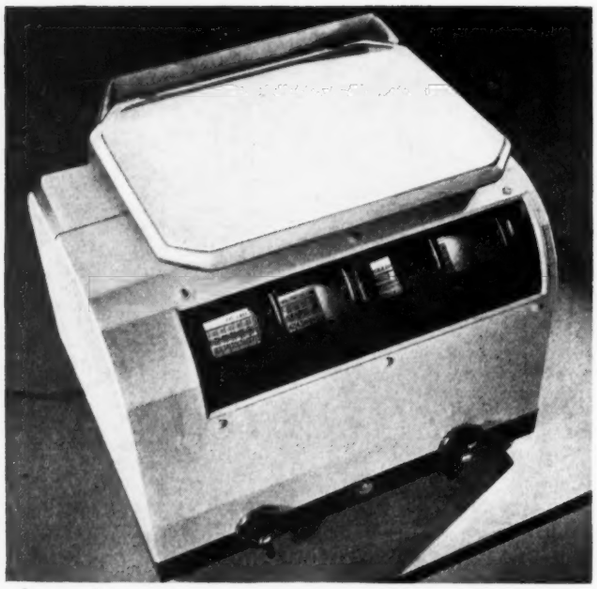


Air King Radio with Case and Knobs of White Plaskon

In the Synthetic Plastic Group of Materials, Plaskon, a Product of Recent Development, has Created an Important Place for Itself

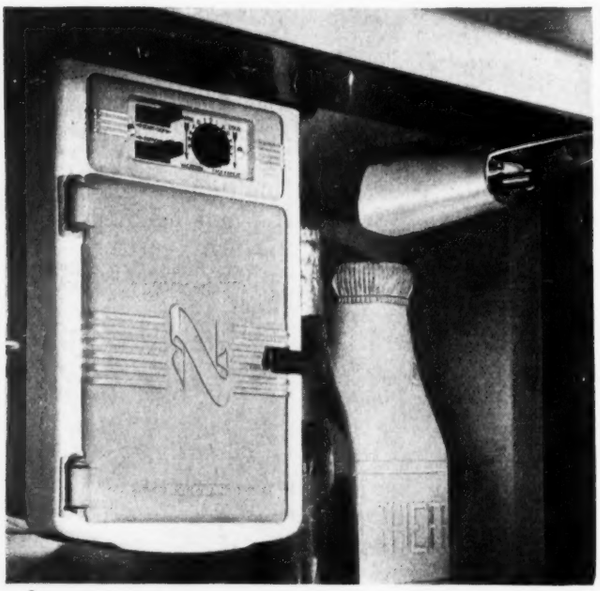
Plaskon is usually supplied to the molder in a granular form. It can also be supplied as a fine powder. The granular-form compound has the advantages of easy preforming, a minimum of dust, and ease of handling and molding. The fine compound is, however, preferable for certain types of flash molds and for castings having large flat or unbroken surfaces. Under these conditions, it facilitates the making of a smooth uniform casting, free from any "dog-skin" effect.

In making parts from this material, it is placed in highly polished steel dies, heated to from 280 to 320 degrees F., and subjected to a pressure of from 1 to 4 tons per square inch of projected area of the piece.



The New Toledo Duplex Scale which is Made with a Complete One-piece Plaskon Case

Plaskon Lighting Fixture Installed in a Kelvinator Refrigerator



The heat first causes the material to soften into a plastic mass. For perhaps twenty seconds, the mass flows into every space available, forming the piece, after which it sets into a hard infusible form. The part is left in the mold or "cured" for from thirty seconds, in the case of small objects such as buttons, to as long as twelve minutes when molding large thick castings, such as radio cabinets or large housings for mechanical devices.

The finished pieces are now taken out of the mold, and the fin or thin collar of material which is forced out at the parting line is removed. This fin is usually only from 0.003 to 0.008 inch thick, so that it can be brushed off with the hand; or the surface may be smoothed down on a polishing wheel.

Precautions in Molding

Plaskon molding compounds in the uncured form are partially soluble in water and can be fused under heat and pressure. After fusing at the required temperature, they are rapidly converted or "cured" to a hard infusible, insoluble, and water-resistant form. It is of importance to note, however, that it is possible to fuse, shape, and remove Plaskon from the mold, obtaining an article with excellent appearance, yet having effected only a very incomplete cure, or none at all. In such an uncured or partially cured form, the material is still soluble in water, brittle, and without strength or durability. Because it is possible to produce such work with good appearance, control in testing is very important during the fabrication of moldings.

It should also be noted that the material deteriorates if exposed to the curing temperature for a longer time than necessary or if an attempt is made to cure at too high a temperature. The result of this tendency to deteriorate with over-curing is twofold in practical molding operations: It means, first, that at the higher range of curing temperatures, the molding must be so controlled that both the maximum and the minimum time limits are observed; and, second, that in molding heavy sections, exceeding 1/4 inch for example, the higher temperature ranges must not be used, because in that case, over-curing of the surface would take place before the inner sections had been long enough in the mold to be properly cured.

Finish on Plaskon Moldings

For many applications Plaskon moldings are used exactly as they come from the mold, after simply removing the fin or flash. For the best grade of products, however, a light buffing will improve the appearance. It is usually not necessary to machine and refinish the moldings, since the molded objects can be made to very close tolerances and have the highest finish possible when they come from the mold. If necessary, however, they can be tapped, drilled, or subjected to any ordinary

machining process. The machined surface can be highly repolished. In any event, the finished pieces are rust- and corrosion-proof, and have a smooth surface and high luster.

In moldings with heavy sections, if inadequate pressure is used, a thick flash may be left. This would necessitate a grinding operation to remove the evidence of the flash line, and after removal such pieces might subsequently show evidences of checking.

For very small compact pieces produced in large numbers, definning, followed by barrel tumbling for polishing, is most economical. Sometimes it is possible to remove the fin and polish in one tumbling operation.

Joining Moldings to One Another or to Other Materials

Plaskon moldings can be joined to one another by being cemented, by pressure fits, and by rivets or screws. Metallic inserts can also be cast directly into the molding, and this is being done to a great extent. Screws, rivets, and other inserts can be molded in place; and parts of other materials, like metal plates, can be attached to the moldings either by screws or rivets. Usually the holes for the screws are cast directly in the molded object and all that is necessary is to run a tap into the hole. Standard taps, the same as are used for tapping steel, are satisfactory. However, should a considerable amount of machining be required for some reason, it is advisable to use tools that are nitrided, made from cemented carbides, or from cobalt high-speed steel.

Controlling Molding Conditions

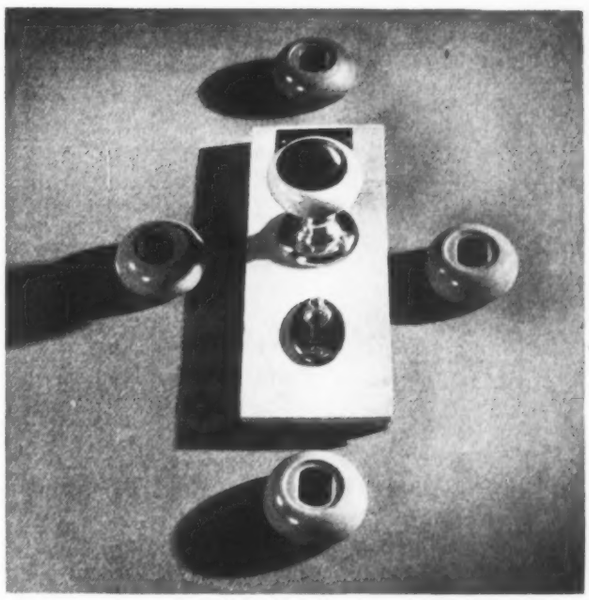
In the fabrication of Plaskon parts, some simple controls and standardized conditions are necessary. For best results, each press should be provided with an individual steam control valve and a steam pressure gage, or an easily read indicating thermometer should be installed in each steam line.

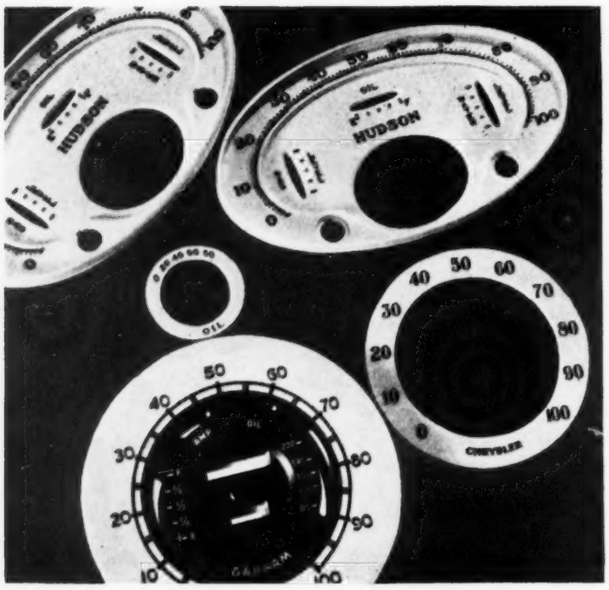
The requirements as to steam pressure or temperature and press tonnage vary with many factors, the most common of which are the thickness of the section being molded, the type of flash, the method by which the mold is heated, and the production requirements. As mentioned, the mold pressure varies between 1 and 4 tons per square inch projected area of the molded part, and temperature requirements between 280 and 320 degrees F. Steam pressures between 45 and 120 pounds are required. The lag between steam pressure and mold temperature will usually vary from 5 to 20 degrees, depending on the construction of the mold.

The greatest pressure is required when molding large flat, thin shapes. The least pressure is required for simple shapes in flash molds. The best results can be obtained only when the compound is

Because Plaskon is Unaffected by the Weather, It is Used in Capcolite Gasoline Pump Frames

Door Knobs Made by the Lockwood Hardware Mfg. Co. in Any Desired Color





Automobile Dashboard Fittings and Gage Dials are Other Applications in which this New Plastic Material Finds Extensive Use

kept under high pressure throughout the flow and cure cycle. This pressure is not determined by the press tonnage alone, but more directly by the completeness with which the compound is sealed against escape. To obtain the best results with a flash mold, for example, it is necessary either to use a stiff grade of compound, to overload the mold, or to close it so slowly on a soft compound that before the mold is completely closed, the compound has stiffened sufficiently to offer great resistance to flow.

For parts such as knobs and gear-shift lever balls, where a mass of material is to be softened and compressed, positive pressure at all times becomes increasingly important. A tight fitting mold is recommended for such pieces, with a slow and even closing of the press.

Depending on the conditions of molding, Plaskon shows an immediate shrinkage after being removed from the mold of from 0.004 to 0.008 inch per inch, followed by a further shrinkage at low humidities up to a maximum of 0.011 inch per inch *from the mold dimensions.* An allowance of 0.010 inch per inch shrinkage from the mold dimensions is recommended, particularly for large moldings such as clock and instrument cases. A slight seasonal variation in dimensions due to atmospheric humidity should be allowed for. This variation has not been observed to exceed 0.003 inch per inch.

Points on the Making of Molds

The dies or molds for molding this new material are made from a good grade of tool steel and hardened. Sometimes the molds are chromium-plated, which aids in giving a higher finish. The same steel is used for the mold as for the plunger or punch. There should be no sharp corners in the molds. Fillets and rounded corners are essential, but they can be of very small radii. Under-cuts must generally be avoided. However, it is feasible to mold such objects as bottle and jar caps with a thread, in which case the cap must be individually unscrewed from the mold. In general, perfectly flat areas should be avoided, curvatures or tapered surfaces being preferable. It is possible, however, to produce perfectly flat surfaces successfully, as, for example, in radio cases.

Molding a Large Casing

The largest molded Plaskon object so far made is the cover or case for the new Toledo duplex scale, which measures 15 3/4 by 17 3/4 by 15 3/8 inches. This case weighs only 8 1/2 pounds, as compared with the 50- to 75-pound cast-iron housings used on previous models of scales of identical capacity. In this instance, the molded case is made from pure white Plaskon material and has the same pleasing appearance as a porcelain-enameled cast-iron case, but it has the advantage that the surface has not a mere finish, the case being solid white Plaskon.

To mold such large pieces, the General Electric Co., Schenectady, N. Y.—the concern that molds these parts for the Toledo Scale Co.—recently installed a giant molding press said to be the largest plastic molding press in the world. It was built to the General Electric Co.'s specifications by the French Oil Mill Machinery Co., Piqua, Ohio. This press is 22 feet high and weighs 89,000 pounds. It has nine hydraulic cylinders operating at pressures of from 1500 to 3000 pounds per square inch. One cylinder operates the main press ram, which is 36 inches in diameter and capable of exerting a pressure of 1500 tons. This ram moves downward to perform the molding operation. The other cylinders operate rams required for auxiliary operations in molding such large pieces as this scale case. Despite its size, the press is operated very rapidly, the main ram being capable of traveling as fast as 100 inches per minute.

The mold or die used with the press to form the

scale case is obviously of huge proportions. It weighs 7 tons; its over-all height, when closed, is 42 inches; and its longest dimension, that of the stripper plate, is 60 inches. Special precautions had to be taken in carburizing and heat-treating this mold to prevent distortion or cracking. This work was successfully done under the General Electric Co.'s supervision at the plant of the Lindberg Steel Treating Co., Chicago, Ill.

Since the molding powders used for the Toledo scale case are pure white, and since a single speck of dirt in one loading of the compound might spoil the entire molding, special precautions must be taken to insure clean air. To begin with, both the main press room and the finishing room are neatly painted and well lighted, and provision is made for scrubbing and flushing to assure cleanliness.

In addition, to guard against the circulation of dust or dirt in the air, an air-filter system has been designed for these two rooms which provides an abundant supply of air free from dust. From a set of glass-wool filters located in the basement under the press room, the air is discharged into the rooms through an air-supply duct having openings of such design as to prevent air currents which might disturb the powdered molding compound.

Since the press room is air-tight, a slight pressure is built up by the air forced into the room, which prevents infiltration of unfiltered air when the door is opened. The system permits of changing the air in the press room once a minute. A similar system of smaller capacity is provided for the room in which the molding compound is stored.

Can a Manufacturer Make His Own Plastic Moldings?

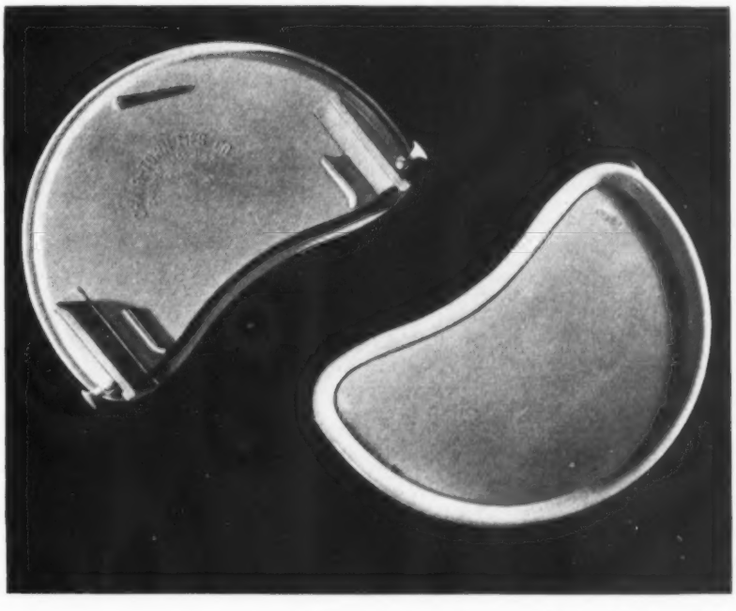
Plaskon moldings are generally made by concerns who specialize in this field. The manufacturer who decides to make use of parts made from this material will generally find it most convenient to obtain moldings from the specialist. Should he, however, require a very large number of parts, it might be advantageous for him to install his own molding presses; but in so doing he should consider the fact that the molding of synthetic plastic parts in general is really a skilled operation, and that as much depends upon the knowledge and skill of the operator of the molding equipment as upon the quality of the press and molds.

Physical Properties and Colors

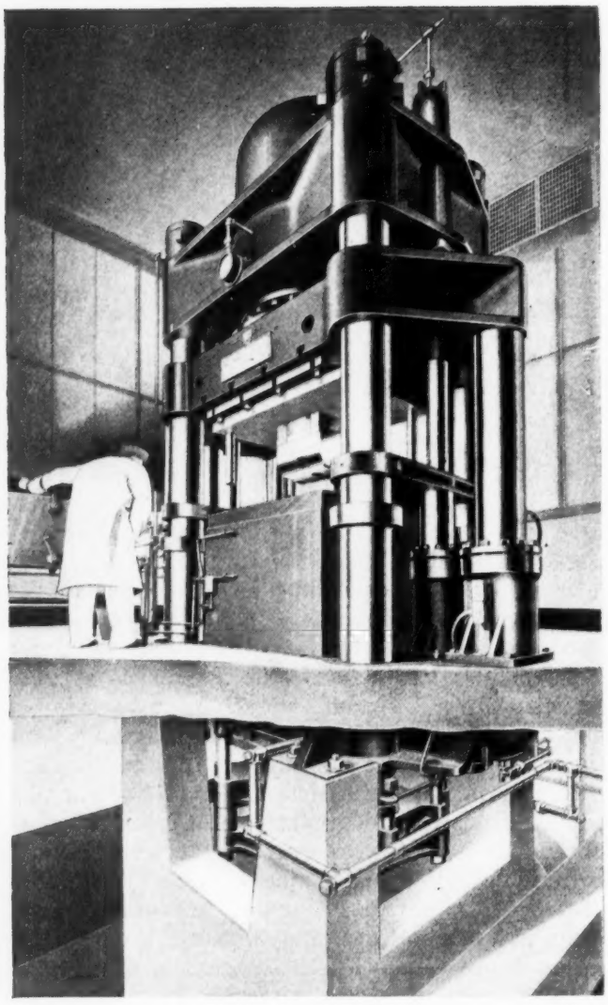
The physical properties of Plaskon may be briefly noted as follows: Specific gravity, about 1.5; flexural strength (modulus of rupture), 10,000 to 20,000 pounds per square inch; compressive strength, 25,000 to 35,000 pounds per square inch; tensile strength, 8000 to 13,000 pounds per square inch; hardness on the mineral scale, 3 to 3.5; hardness on the scleroscope scale, 80 to 95.

A standardized line of colors has been adopted by the makers of this material, containing twenty-one shades ranging from snow-white through delicate pastels and brilliant hues to a lustrous black. It is, however, possible, should it be required, to obtain the material in other colors as well, since the range of shades is almost unlimited. In fact, the material has been made in over 6000 shades; and it is possible to duplicate any color once produced. One of the interesting facts about many of the Plaskon colors is that they are resistant to ultra-violet light. They are extremely stable when exposed to light, and the color is permanent —it will not fade. Furthermore, the color is uniform throughout the molded object and the molding is homogeneous.

This new material has already been applied to so many uses that it is possible to enumerate only a few; but even a partial list of the uses to which Plaskon has been applied would include buttons



Tray for a Baby's High Chair Molded from Plaskon— Strong, Pleasing in Appearance, Easy to Clean



What is Said to be the Largest Molding Press in the World is Used by the General Electric Co. for Very Large Plaskon Moldings

and buckles, in the manufacture of which uniformity of color is of importance; closures, from the tiniest caps for perfume bottles to covers for jars 4 inches in diameter; oil-cups; containers for numerous products; lamps and lamp shades; outlet plugs; bathroom fixtures; valve handles, where different colors are of importance; cases for meters, speed counters, and recording machines, especially where white colors are desired; dash panels and knobs for automobiles; handles for stoves, etc.

Plaskon is highly light-transmitting and reflecting, which enables it to be used successfully for light shades and fixtures. Owing to its non-shattering nature and ability to withstand shock and vibration, it makes an ideal material for lamp shades to be used on or near heavy machines and factory equipment.

This material is tasteless and odorless, and for that reason, is frequently used in the manufacture of molded tableware for hot food and liquids. It is infusible and non-inflammable.

Having a hard surface and being resistant to the action of oil or grease, it may be used as a substitute for metal in many machine parts, such as casings, covers, knobs, controls, instrument dials, etc. Objects made from it can be frequently handled and washed without deterioration and without affecting the polish or luster. In fact, such objects are likely to improve in polish from handling. The material is resistant to the common organic solvents. It can be submerged in alcohol, acetone, oils, gasoline, etc., for indefinite periods without harmful effects. Hence it is extensively used as a material for containers for creams and salves having an oil or grease base.

Its low heat conductivity and its ability not to soften at elevated temperatures have led to the wide use of Plaskon for stove handles, heat-regulator handles, and similar purposes.

There are some applications for which it is not recommended; it should not be used for objects that may be exposed to very high temperatures or boiling water, or where the sections may be unusually heavy. Among these may be mentioned percolator filters, parts to be sterilized by boiling, high-temperature electrical connectors for heavy-duty cords, billiard balls, and, in general, plates thicker than 1/4 inch. It should be noted, however, with respect to the last-mentioned item, that it is feasible, with careful control, to mold pieces with much thicker sections; and parts having sections from 1/2 to 1 1/2 inches thick have been produced successfully.

Designing for the Application of Plaskon

When the machine designer decides to use Plaskon for some parts, he may in many cases be able to use the same design that he has used when employing metal; but in most cases, an improved design can be obtained in a plastic material, one that may serve its purpose better and be more pleasing to the eye. For those who are considering the use of parts made from this material, the Toledo Synthetic Products, Inc., maintains, at Toledo, Ohio, a service bureau for designers, where they may obtain suggestions and advice concerning applications and ideas as to the most suitable design for the Plaskon parts required.

Welding Machines for Assembling Automobile Parts

Special Hydraulically Operated Welding Machines that can be Readily Altered to Suit Changes in New Car Models Have an Important Part in Automobile Production

By C. M. TAYLOR, Vice-President
The Lincoln Electric Co., Cleveland, Ohio

FEW industries have profited as much from welding as the automobile industry. The turning out of the millions of separate parts required in building a month's quota of cars would be a most formidable task were it not for the fast production obtainable through welding. This process is used in the construction of mufflers, starter and generator frames, torque tubes, rear-axle housings, brake cross-shafts, wire wheels, tail-light brackets, tire-carriers, and many other parts. Even chassis frames and bodies are now welded electrically.

Automobile mufflers, for example, are fabricated at the rate of 250 complete units every hour. Generator and starter frames also come off the welding production line at the rate of 250 an hour. Other parts are welded at similarly high speeds.

Multi-hydromatic machines designed for the rapid welding of panels, floors, and other parts are among the latest developments in this field. These machines, shown in the accompanying illustrations, are built by the Multi-Hydromatic Welding & Mfg. Co., Detroit, Mich. Arc welding is used in constructing these welding machines to provide ample rigidity and strength and also to facilitate making the alterations required to meet yearly changes in body construction. These machines make as many as 127 welds in fifteen seconds. This rapid welding is all automatic and is actuated by cams and hydraulic cylinders operated by a Lincoln electric motor.

Capacity of Hydromatic Welding Machines

Since the hydromatic welding machines are built for welding various types of automobile bodies, the size range is wide. Thus, in one application, a machine might be capable of making ten welds in fifteen seconds, while in another application, the machine might be required to make 127 welds in the same time. Owing to this wide range of machine sizes, many different sizes of channels, angles, and plates are utilized in the construction of the welding machine. These parts are assembled, tack-welded in place, and then welded permanently by the shielded-arc process.

One type of hydromatic machine is shown in Fig. 1. The rectangular base and top of this machine are made up of channels. The four sections of channels of the base are welded together at the corners and rest on square pieces of plate. Extending up from and welded to each corner of the base is a length of angle-iron which is welded to the top channel, also at each corner.

The multi-hydromatic machine is carried on a secondary frame built by welding angles and plate together. The secondary frame is supported by

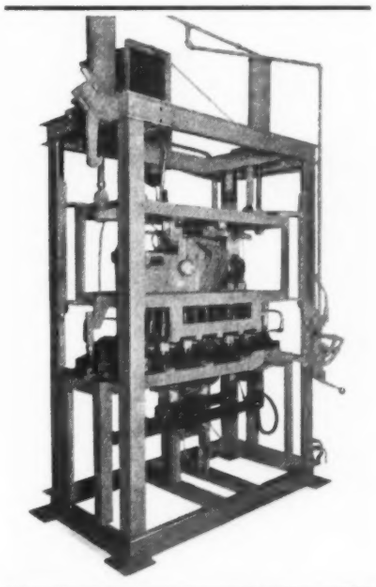


Fig. 1. A Multi-Hydromatic Type Welding Machine which Makes 127 Welds in Fifteen Seconds in Assembling Panels and Floors for Automobile Bodies

additional angles resting on and welded to the end channels of the bottom of the main frame. The mounting of the machine is such that it can be elevated so that work can be placed under it, and it can also be removed when occasion requires. The hook on the top left-hand side of the frame holds the machine up when not in use. The entire framework is given ample strength and rigidity by the use of additional lengths of angles and channels. This multiplicity of parts becomes one integral piece of steel when welded together.

How the Multi-Hydromatic Welding Machine Operates

The various working parts of the machine can be seen in Fig. 1. The two cylinders on the top of the machine are for air. The control unit is the square box-like part, also on top of the machine. The contactors which make the welds appear as small points just below the center of the unit. The oil that actuates these contactors is forced by pressure through the copper tubes to the right of the gage.

In operating multi-hydromatic machines, the unit is raised from the baseplate and held suspended by the large hook while the sheets to be welded are placed in position. Suspending the machine in this way relieves the air cylinder of strain and protects the machine and the operator in case the air pressure should be reduced or fail.

The work to be welded is placed on the bed. Then the unit is lowered on the work by means of the lever on the right-hand side of the frame. The operator now presses a button, which starts the electric motor. The motor rotates the cams which travel across the cylinders. As the cams strike the piston, pressure is applied to the contact points, forcing them against the work. A current of electricity then passes through the work, making the welds at the desired points. When one job is welded, the welding head moves up away from the work, which is removed to make way for the next sheets to be welded. Fig. 2 shows a machine in use in a large automobile factory.

The advantages incident to the use of these machines are readily apparent. The operation of the machines is entirely automatic, whereas the former methods employed required preheating of the metal or else were limited to making single spot welds. The multi-hydromatic machines not only make welding instantaneous, but also permit the making of a large number of welds at one time. In addition to these advantages, the machines can be easily altered, because of their arc-welded construction. This ready adaptability is essential, since automobile body lines change yearly. One large builder keeps seventy of the machines in use regularly.

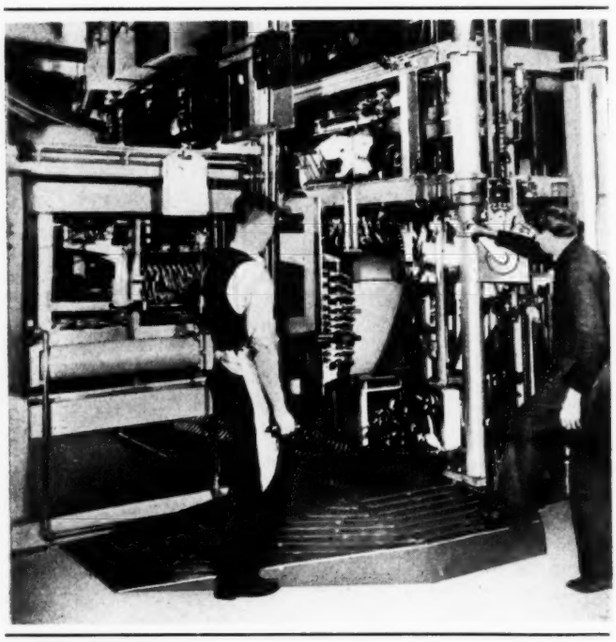


Fig. 2. A Multi-Hydromatic Welding Machine in Operation in an Automobile Plant

* * *

Do Not Jump at Conclusions about Lubricants

In a recent number of *Oil-Ways*, published by the Standard Oil Co. of New Jersey, E. H. Arrington relates the following experience, which points to the danger of jumping at conclusions in selecting lubricants: A southern mill had a fine reputation for economy of operation. It was using an excellent turbine oil in the steam turbine that operated the plant machinery. Business started to pick up. Some machinery additions were required, and a new Moore turbine was installed.

Not long after the new unit was installed, a lubrication engineer, forty miles distant, received an urgent telephone call to come to the plant. The turbine was "burning up." He thought it was the machine used for years in the plant and for which he was supplying the correct oil. When he arrived, he was shown the new machine. Running at high speed and temperature, the bearings were ready to burn. He ordered the machine stopped. A few questions, and he learned that the new turbine was being oiled with the turbine oil used in the old unit, which was entirely unsuited for the Moore machine.

No one had asked the engineer for a recommendation for the new turbine. Turbines were thought to be all alike in their oil requirements, and all turbine oils alike in their characteristics. The engineer recommended the proper oil for the new machine, which required an oil heavier than the usual turbine oil. When the recommended oil was applied, no further difficulties were experienced.

High-Speed Riveting Fixtures

By WILLIAM C. BETZ, Equipment Engineer
Fafnir Bearing Co., New Britain, Conn.

MULTIPLE riveting is an economical method of fabricating such parts as locks, ball retainers, clocks, toys, novelties, and similar assemblies that are produced in large quantities. The rotary type of riveting fixture, shown in Fig. 1, is the type best suited for the multiple riveting of work that can be located in a circle. For odd-spaced riveting, either a cushion-helve hammer, such as is made by the High Speed Hammer Co., or the especially designed riveting machine shown in Fig. 2 will do the work satisfactorily.

A large drill press makes a simple arrangement for operating the multiple riveting tool for such work as riveting ball retainers or any other work where the position of the rivets in the piece can be arranged so that the riveting can be done with the rotary type of hammer shown in Fig. 1. A fixture of the kind shown can be made for riveting small groups of small-size rivets arranged in multiple, as shown in the upper view, Fig. 3, or it can be arranged for riveting single rivets of larger size. These fixtures may be built into a standard die set or the upper and lower blocks may be bored for pillars, as shown in Fig. 1.

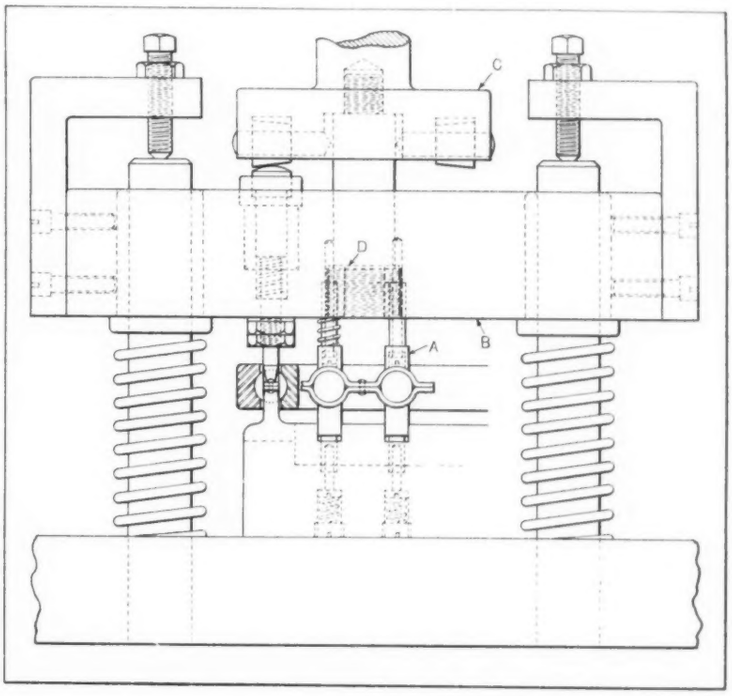


Fig. 1. Rotary Type of Multiple Riveting Fixture

In multiple riveting, the first thing to consider is the locating device for bringing the work into position and holding it so that the rivet or stake is in line with the riveting hammer. In the case of the retainer shown in Fig. 1, the locating is done from the loop of the retainer pocket through the spring-operated pads *A* on which the retainer rests as it is being riveted. These pads remain in contact with the work and keep the rivets in position while they are being headed down.

The riveting hammer-block *B* and the roll hammer-head *C* shown in Fig. 1 need little explanation. The hammer-block, in which the riveting hammers are located, works up and down on the spiral springs encircling the pillars. Smaller springs are located under each riveting punch, so that an up and down motion is imparted to the punches when the press spindle is rotated and the roll hammer-head is brought into contact with the heads of the riveting punches. As the press spindle is brought down still farther, the center stud in the hammer-head makes contact with the bushing *D* which carries the head down to the work by depressing the pillar springs.

When the work is finished, the press spindle is raised, bringing the hammer-block up with it through the action of the pillar springs. On raising the spindle still farther, the roll hammer-head is raised out of contact with the riveting punch heads. This allows the machine spindle to rotate continuously without undue wear on the punch heads and rollers.

Riveting hammers may be made with or without rollers. If made without rollers, rollers must be put into the ends of the riveting punches and the hammer-head face must be milled with a series of high and low points, as shown in the upper view to the left in Fig. 4. Still another type of head utilizes rollers without pins. In this type, the roller pocket is milled or bored into the periphery of the hammer-head and the solid rollers are retained by a thin plate in which slots are machined to a size a little smaller than the diameter of the rollers; or the ends of the roller seats may be plugged with screw plugs, as shown in the lower

view to the left in Fig. 4. The rollers in this type are allowed ample play in their seats and may be either tapered or cylindrical, both designs being shown in this view. The hammer-head in this case is hardened.

It sometimes happens that the riveting hammer must revolve while it rivets, as when riveting a round head. This may be accomplished in one of three ways: First, if the spacing of the rivets will permit, a rubber-tired pulley which is driven by friction when it comes in contact with the hammer-head may be used to revolve the riveting hammer; second, if the riveting hammer centers are close, volve the hammers as each roller strikes (see Fig. 1).

In designing revolving individual hammer drives, the center driving pulley should be made as small in diameter as possible, and the driven pulleys should be kept as large as possible, in order to reduce the rotating speed of the work hammers to the minimum. For revolving the disk-driven punches, the pilot will drive better if it is knurled.

It often happens that a high-speed helve type hammer is not available. In cases of this kind, it might be better to build a machine complete, as shown in Fig. 2, for the work on hand rather than

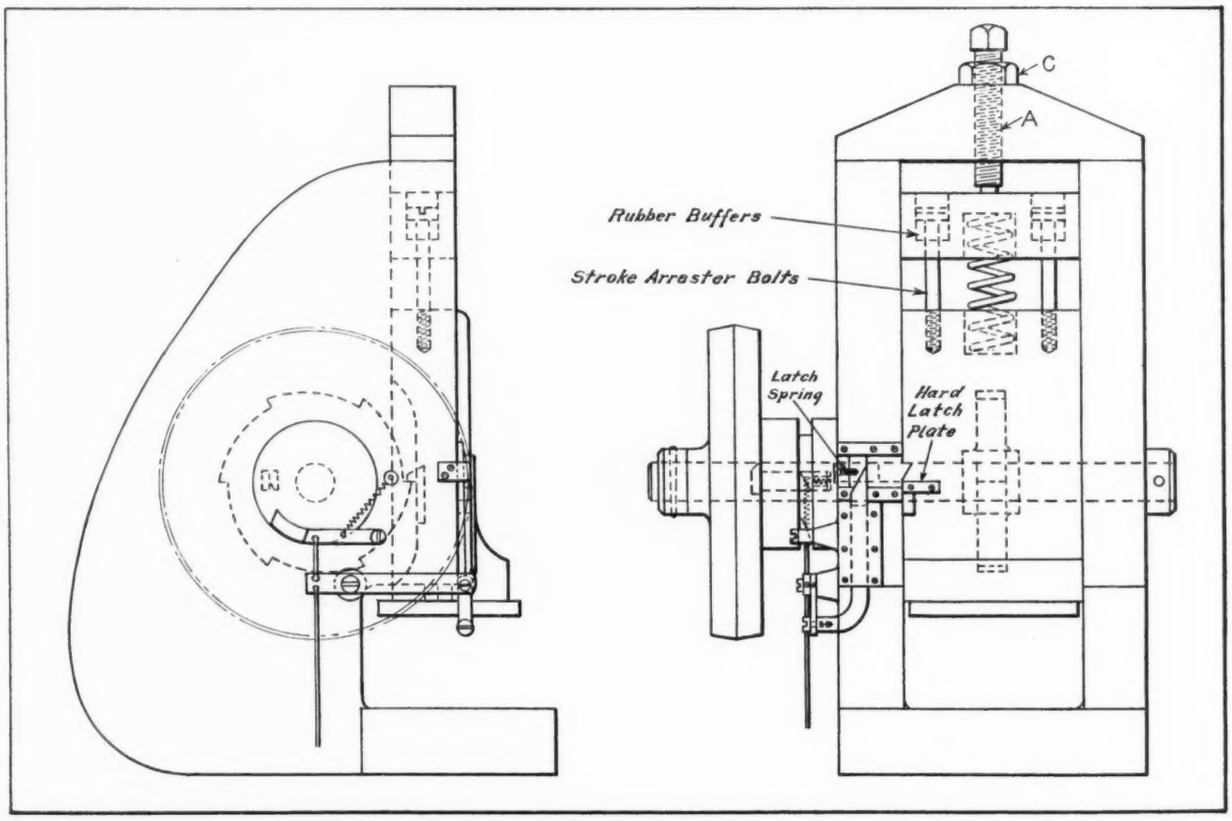


Fig. 2. Riveting Machine with Ram Actuated by Compression Spring, the Amount of Pressure on which can be Adjusted

a belt of rawhide driven by the hammer, which is rotated through a worm and wheel, is wound around a pulley encircling the riveting punch heads, in the case of the high-speed hammer type machine. As the main head revolves, the riveting punches also revolve. The pulleys that drive the riveting punches are so keyed to them that the punches have a free motion vertically (see the views to the right in Fig. 4).

The third method of revolving the individual punches which can be applied to the drill press type of head consists of having the rollers ground with their faces slightly on an angle, so that the blow, instead of striking the dead center of the heads, strikes slightly to the inside or outside of the head centers. This arrangement has a tendency to re-

to buy a hammer. This machine is made up of a main frame with a free-sliding ram similar to a light power press. Both of these members are made of malleable iron. The ram is raised through the rotation of a hardened-steel ratchet wheel in contact with a pawl which is fastened in the ram, energy being provided by the adjustable tension spring at the top of the machine frame. This spring forces the ram down as each tooth of the ratchet wheel raises it to its releasing height. This machine can also be used on single rivet work.

The question may be raised as to why malleable iron is used for the frame and ram. Frames made of cast iron have been tried out on machines of this type and have failed. Parts made of malleable iron, however, have given good service. Excellent

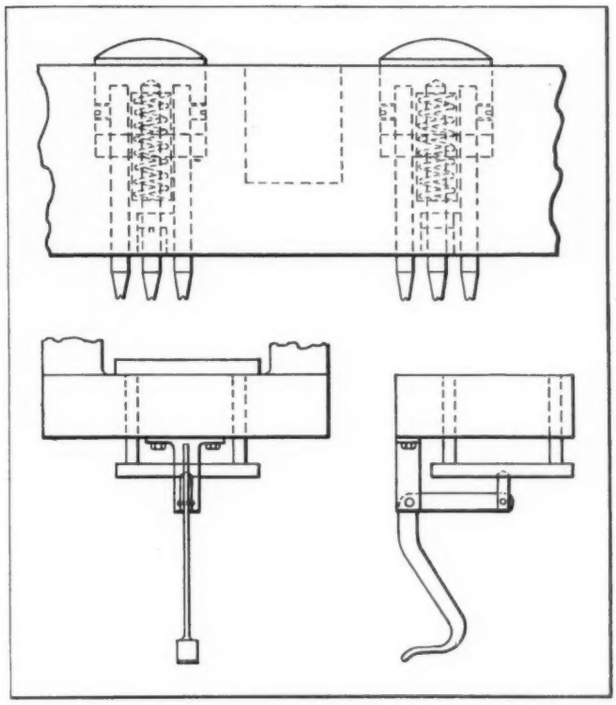


Fig. 3. (Upper View) Arrangement of Multiple Riveting Punches in Groups. (Lower View) Foot-pedal Arrangement for Raising and Lowering Riveting Fixture to Permit Changing Work

service has also been given by a very small machine in which the parts were made of tough bronze castings.

The space required for placing the work between the anvil and riveting hammers of the machine shown in Fig. 2 may be provided by either of two methods. One method consists of raising the anvil (see lower view, Fig. 3) into contact with the riveting hammers by means of a foot-lever and at the same time releasing the dog clutch, thus rotating the spindle. When the riveting is completed, the anvil is dropped, and the dog throw-out releases the flywheel from the spindle.

The other method consists of employing a double-action lever which releases the dog in the flywheel at the same time that the latch shown in Fig. 2 is thrown out of contact with the ram. On completion of the riveting operation, the foot-lever is depressed, which releases the ram latch, as well as the flywheel dog latch, throwing out the flywheel dog when it makes contact with it. The ram latch is released before the dog latch, owing to the fact that the flywheel must carry the dog around at least a part of a turn to bring the latch into contact with the dog. This insures that the ram is raised so that the ram latch makes contact with the slot and holds the ram up so that the work can be inserted.

Another essential detail concerns the correct spacing of the ratchet teeth in the wheel. These teeth must be so spaced that when the ram is released at its high point of travel, it has ample room to drop on the work without interference from the next tooth as it comes around. Just what the tooth space must be, however, depends a great deal on the speed of the spindle.

In driving the drill press type of hammer, the speed of a head measuring up to 5 inches in diameter should be at least 200 revolutions a minute to strike one thousand blows a minute. This means that the hammer-head must have five contact rollers to strike this number of blows. Larger heads could run more slowly and have more rollers.

One thousand blows a minute is about the maximum speed at which any of the machines shown should be run. In laying out and making the riveting hammers, care should be taken to see that the heads do not extend more than 1/16 inch above the pathway of the lower side of the rotating rolls, in order to allow the rolls in the driving head to strike the tops of the riveting hammer-heads a blow, which they could not do if the hammer-heads were allowed to extend too high between the rolls on their upward stroke.

The proper stop or low position for the upper

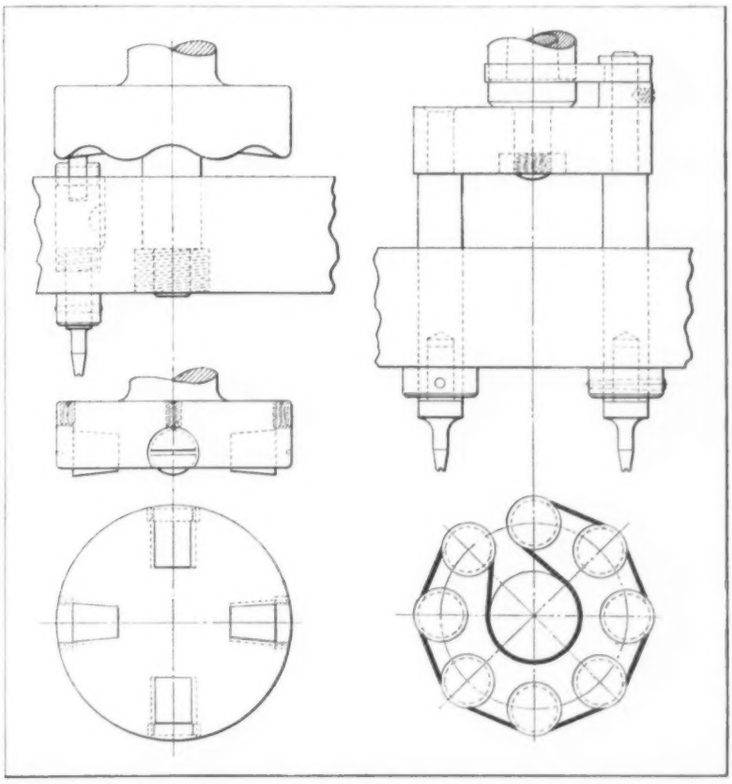


Fig. 4. Alternative Methods of Actuating Riveting Punches of the Multiple Type

member of the fixtures in the helve and rotary type must be determined by trial. Stops may be set either on the drill press spindle or on the pillars of the die sets, as shown. The upper or riveting section on the helve hammer is brought to the stop position by bringing the hammers down on the rivets or stakes and binding the upper die set slide to the pillars. Adjustment for spring tension and hammer blow on the riveting machine shown in Fig. 2 is made through the adjusting screw *A* in the top of the frame, and is locked by the binding nut *C*.

William L. Batt, New President of the A.S.M.E.

WILLIAM L. Batt, president of the S K F Industries, Inc., Philadelphia, Pa., has been elected president of the American Society of Mechanical Engineers for the year 1936.

Mr. Batt was born in Salem, Ind., in 1885. His family later moved to Lafayette, where he attended the public schools and Purdue University, from which he graduated in 1907 in mechanical engineering. In 1933, he was honored by his Alma Mater, Purdue University, with the degree of Doctor of Engineering.

William L. Batt, Newly Elected President of the American Society of Mechanical Engineers

Prior to his graduation and for a short time afterward, Mr. Batt was associated with Dr. W. F. M. Goss, then Dean of Engineering of Purdue, in the private professional work which Dean Goss then carried on. After Dr. Goss's departure from Purdue, Mr. Batt became associated with the Hess-Bright Mfg. Co., Philadelphia, Pa., in the ball bearing manufacturing, engineering, and sales departments. In 1917, he became general manager of the company; and following the consolidation of the S K F Ball Bearing Co., the Hess-Bright Mfg. Co., and other organizations, he became vice-president of the S K F Industries, Inc., the central organization. In 1922, he was made president of this company, an office which he has held ever since.

Mr. Batt became a member of the American Society of Mechanical Engineers in 1911 and has been unusually active in its work, serving the Society and the engineering profession as a whole in many capacities. He has been chairman of the Revenue Committee, chairman of the Committee on Meetings and Program, chairman of the Coordination Committee of Engineering Societies, and a member of the Market Analysis Committee and of the Committee on Awards. He is at present a vice-president of the Society. Mr. Batt's contributions to the work of the American Society of Mechanical Engineers and to the interests of the engineering profession as a whole have been unusually constructive. He has also been active in the work of the Society of Automotive Engineers.

Mr. Batt is engaged in many varied activities. He is a director of the Air Preheater Corporation and a director of the Hudson Insurance Co., New York. In 1923, he was elected a member of the board of directors of the Swedish Chamber of Commerce of the U. S. A., and in 1926 was elected vice-president. For his interest and activity in promoting commercial relations between the United States and Sweden, King Gustav of Sweden in 1926 conferred upon Mr. Batt the decoration of the Order of Vasa, and in 1933, the Royal Order of the North Star.

In all his activities, Mr. Batt brings to bear upon any question at issue, an unusually clear and analytical mind, with a rare capacity for arriving at conclusions based upon an accurate evaluation of all the factors involved.

* * *

Higher Wages Depend on the Machine

Labor cannot be paid high wages for short hours except as engineers and machinery and planning provide the means by which the workers are enabled to earn high wages with short hours. Without machinery and organization and quantity production, no man can earn high wages with his hands alone. The intelligence of management and designers must supplement the mind and brawn of the worker through the accuracy of the machine. —*William B. Stout*

Finishing Zinc and Aluminum Die-Castings

By HERBERT CHASE

Die-Castings May be Used as They Come from the Casting Machine or They May be Provided with Various Finishes. Lacquering, Enameling, Japanning, Varnishing or Plating are the Processes Commonly Used—Second of Two Articles

IN the first installment of this article, published in October MACHINERY, the comparative costs of different finishes were reviewed and directions were given for the preparation and cleaning required previous to applying finishes to die-castings. In the present and last installment of this article, specific directions will be given for applying different types of finishes.

Plated Die-Casting Finishes

Nickel is recommended as the base coat on aluminum, and usually also on zinc. For zinc castings such as automobile hardware that is exposed to the weather, some large companies recommend a thick first coat (at least 0.0005 inch) of copper, followed by from 0.0003 to 0.0005 inch of nickel and 0.000025 inch of chromium. A minimum of 0.001 inch total thickness of copper and nickel is recommended for outdoor exposure. It is well known that flash coats of copper on zinc alloys are quickly dissolved in the zinc, but thick coats last for long periods at normal temperatures and are reported to give excellent results with the subsequent coats of nickel and chromium. Nickel plated directly on zinc gives good results, even when subjected to outdoor exposure, provided a minimum thickness of from 0.0003 to 0.0005 inch is used. When thinner coats are exposed to moisture, which penetrates the film, the moisture often brings white oxide to the surface, but this can be rubbed off easily, though in time, some pitting will result.

Nickel-Plating on Zinc Die-Castings

The following solutions for nickel-plating on zinc are recommended and extensively used:

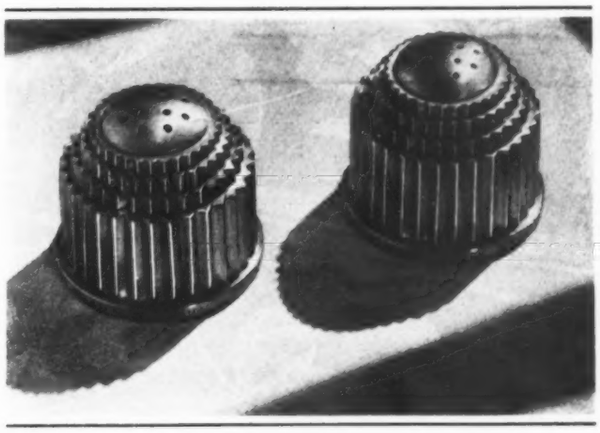
Nickel sulphate, 10 ounces per gallon of water.
Anhydrous sodium sulphate, 10 to 15 ounces per gallon.
Ammonium chloride, 2 to 3 ounces per gallon.
Boric acid, 2 ounces per gallon.

The recommended pH (colorimetric) is 5.8 to 6.2; the plating is done at room temperature with a current density of from 15 to 18 amperes per square foot, which gives a coating about 0.0003 inch thick in twenty minutes.

A more concentrated bath contains:

Nickel sulphate, 15 to 18 ounces per gallon of water.
Anhydrous sodium sulphate, 15 ounces per gallon.
Ammonium chloride, 3 ounces per gallon.
Boric acid, 2 ounces per gallon.

Recommended pH (colorimetric) is 5.5 to 5.9; plating temperature, 80 to 90 degrees F.; current density, 24 to 36 amperes per square foot, giving a 0.0003-inch deposit in eleven to fifteen minutes.



Salt and Pepper Shakers Die-cast from Zinc, with a Scratch-brush Nickel Finish, which is More Practical for Articles with Irregular Surfaces than Buffed Plating

Reduction in porosity of coatings results, and high current densities are permissible, when the castings being plated are agitated during the plating. Both baths give a good quality of plate having reasonable ductility.

Other solutions available to produce a black nickel deposit on zinc, and a bright deposit of nickel requiring no buffing, can be made by adding to the solutions given in the foregoing 0.0167 ounce of cadmium sulphate per gallon. This coating is somewhat brittle, however, and should not be used as a base for subsequent coats of chromium.

Chromium is successfully plated over nickel deposited from the "standard" solutions given (without additions of cadmium sulphate), and the same is true of copper, brass, bronze, cadmium, silver, and gold. Some plating has been done with chromium plated directly on zinc, without nickel under coats, but, so far as the writer is aware, the process has not been extensively used commercially. It sometimes gives deposits that are difficult to buff to a satisfactory luster.

When zinc die-castings are required to have more than their normal corrosion resistance, they can be given a greater resistance by the formation of a dichromate film on the surface. This is produced by a simple dipping operation devised and patented by the New Jersey Zinc Co. The film supplies corrosion inhibiting material sufficient for long periods, and gives the casting a golden brown to greenish appearance, depending partly on the copper content of the alloy.

Plating Aluminum Die-Castings

Plating on aluminum, once considered rather difficult, is now done successfully by competent platers who use reasonable care to maintain correct conditions. When the metal is properly prepared and good plating practice is followed, the coating is adherent and enduring, but it is easy to produce a good looking deposit that is deficient in both respects; hence careful checks should be made. A good plate does not show a tendency to flake at the fractures when castings are broken, and will withstand salt spray tests for 30 hours or more without blistering or flaking.

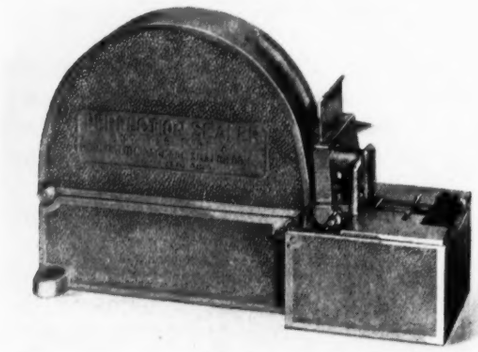
The following solutions for plating nickel on aluminum are recommended:

Nickel sulphate, 19 ounces per gallon of water.
Magnesium sulphate, 10 ounces per gallon.
Ammonium chloride, 2 ounces per gallon.
Boric acid, 2 ounces per gallon

or

Nickel sulphate, 16 ounces per gallon of water.
Sodium sulphate, anhydrous, 26 ounces per gallon.
Ammonium chloride, 2 ounces per gallon.
Boric acid, 2 ounces per gallon.

Plating with either solution is done at a temperature of about 90 to 95 degrees F. with a 15-ampere current density and colorimetric pH values of 5.8 to 6. Frequent additions of hydrogen peroxide prevent hydrogen pitting, but an excess reduces throwing power and cathode efficiency. Chromium, brass, copper, silver, and other metals can be plated over nickel deposits on aluminum.



Sealer and Dispenser for Gummed Paper, Die-cast Either from Aluminum or Zinc Alloy. The Aluminum Castings are Polished, but not Plated; the Zinc Castings are Plated or Enameled

Very hard and wear-resistant anodic oxide coatings can be applied to some aluminum-alloy die-castings, and as these coatings are very porous, they can be colored readily by the use of various pigments and dyes. Some of the finishes thus produced are striking in their brilliance and color and are also very serviceable. The process is patented and licensed under the trade name Alumilite.

Preparing Die-Castings for Lacquering, Enameling or Japanning

The cleaning of either zinc or aluminum die-castings prior to applying an oleo-resinous finish, so far as solvent or alkaline cleaners is concerned, may be much the same as that recommended for plating, and the same solutions may be used. No polishing is required unless the castings are unusually rough, and, of course, no fine-polishing or buffing is done, except when a clear finish is to be used over a polished surface.

Fine sand-blasting is sometimes recommended as the only preparation for finishing required on zinc alloy castings, but is not advised for aluminum alloys. The surface produced makes for excellent adherence of the oleo-resinous film, but excessive

sand-blasting should be avoided, as it may remove the smooth surface layers of the casting and possibly expose fine pores, which sometimes occur just below the surface of die-castings.

An alternative recommended for zinc when sand-blasting is not done is scratch-brushing. Either sand-blasting or scratch-brushing, however, should be very fine if a single coat of finish is to be used, as it may otherwise prove difficult to produce a finish having uniform luster. Lacquer coats, which are very thin, often accentuate scratches and other surface inequalities and do not fill them.

If a slight chemical roughening of the surface is preferable to a mechanical roughening, etching with acid is satisfactory. Etching of zinc is done as follows: (a) By a thirty-second dip in a 1 per cent solution of 48 per cent hydrofluoric acid; (b) by a fifteen-second dip in a 3 per cent solution of 85 per cent phosphoric acid (specific gravity, 1.704); (c) by a fifteen-second dip in a 10 per cent solution of 35 to 37 per cent hydrochloric acid (specific gravity, from 1.18 to 1.19). This should be followed by a thorough rinse, and if any undissolved copper salts remain on the surface, they should be removed by brushing before a finish is applied.

Cleaners for Die-Castings Used Preparatory to Lacquering and Enameling

It is not essential, though it is often recommended, that zinc be slightly roughened by one of the foregoing methods, to secure proper adhesion of the finish. A good solvent cleaner, such as trichlorethylene, preferably applied by the vapor method, is often satisfactory, especially if the finish is a good synthetic enamel and is baked on. Alkaline cleaners are also used effectively. A good solution is one containing 6 ounces of trisodium phosphate per gallon of water, used boiling hot and preferably as an electrolyte with the casting as a cathode. The cleaning is complete in from one-half minute to two minutes and should be followed by thorough rinsing in hot and cold water. If any film of alkaline salts remains on the surface, it should be removed by a short dip in a 10 per cent hydrochloric acid solution, followed by immediate rinsing.

Castings thus cleaned or, in fact, cleaned by any other method, should be coated as soon after cleaning as possible, but not before giving them a short bake at a temperature sufficient to evaporate any water that may remain in the pores (and subsequent cooling to room temperature), as otherwise such moisture is likely to produce blistering of the finish. This applies to aluminum as well as to zinc.

Aluminum castings require care in cleaning, but surface roughening is seldom recommended, as good adherence of organic coatings is secured without it. Etching with a weak phosphoric acid solution can be employed, however, if the coating is subjected to unusually severe treatment. The same alkaline cleaner used on aluminum prior to plating can be used or a good solvent cleaner can be employed, if care is taken to see that no film of grease remains.

Slight traces of grease or oil on metal surfaces to be lacquered are likely to result in peeling and may prevent drying. Even finger prints should be avoided, as they may show up after lacquering. Although all oil and grease should also be removed before applying a baking enamel, slight traces of these are less serious than with lacquer.

The Application of Enamel as a Finish

Although some excellent lacquers for die-castings are available, they are seldom used on die-castings unless baking equipment for enamels of the synthetic type is not available and fairly rapid drying is required, for reasons pointed out in the first installment of this article. The advent of high-grade synthetic enamels has resulted in displacing lacquers in many fields, largely because the enamels give a better finish from nearly every standpoint, especially if only a single coat is to be used. This is true on die-castings as well as on other metal surfaces. It is not even necessary to bake all enamels, as over-night drying types are available; but baking improves the finish in adhesion and other enduring qualities.

The temperature and time required for baking enamels vary with the make or composition. The Glyptal type, now widely used, does not darken noticeably in baking or in service, even with light colors, if recommended baking temperatures are not exceeded and proper pigments are used. This type also has good moisture resistance. Such finishes may be baked for one hour at 300 degrees F. or for one and one-half to two hours at 225 to 250 degrees F. White and light colors are seldom baked above 225 degrees F., as discoloration is likely to result.

Enamels vary widely in composition, however; hence the recommendations of the individual maker of the finish used should always be followed, except that zinc castings should not be baked at temperatures much above 300 degrees F., as the zinc alloys begin to soften at higher temperatures. Aluminum alloys are not affected by any baking temperature that an organic finish will stand.

Lacquering and Varnishing Zinc Die-Castings

Zinc die-castings that have been polished and are not to be plated can be protected against tarnishing either by lacquer or by a clear synthetic varnish. Very thin coats of fairly enduring lacquer are colorless and do not darken noticeably with exposure; but they are less resistant to some deteriorating agents than clear synthetic varnishes. The latter have practically the same properties as enamels and are the same in composition except for pigment content.

Some of these varnishes are very light in color and do not darken much when aged; hence they

do not alter materially the color of the bright metal which they cover. It is thus possible to polish certain parts of die-castings, such as raised designs on the surface, and to finish the remainder in a contrasting color, while the polished surface is protected from tarnishing by a clear finish. Or the entire casting may be polished and similarly protected, so that it appears much like a plated casting. This is an important consideration in certain decorative applications of zinc castings where the cost of plating would be prohibitive. Polished zinc has much the same color as polished chromium, but unless the polish is covered by a protective coating, tarnishing soon takes place.

If, as happens in some cases, a polished zinc surface is darkened during the baking of a clear coat over it, it may become necessary to treat the polished surface with an anti-oxidizing chemical. However, a treatment of this kind is very inexpensive.

Because of the good polish that aluminum holds over long periods without any protecting finish, clear finishes are seldom applied, but there is no reason why either clear lacquer or clear varnish cannot be employed on aluminum with good results, if desired. The same pigmented finishes used on zinc also give at least equal results on aluminum.

Applying Finishes by Spraying

It should be pointed out, perhaps, that most production work in applying organic finishes on die-castings is now done by spraying, but that dipping can also be employed, and even brush application on small areas is feasible with certain finishes. What is termed a single "double-cross-spray" coat is often sufficient, but, of course, best results are secured with more than one coat. These may be of the same material or may involve primer, surfacer, and finishing coats, as on many other metal products.

In general, die-castings are so smooth as not to require a surfacer to fill up irregularities, but surfacers can be applied when required or spor putty can be used after priming. Lacquers are sometimes employed to advantage as finishing coats over baked synthetic under coats, but if baking equipment is available, it is probably better to use final coats of synthetic enamel, except under unusual circumstances.

Enamel coats can be had in almost any degree of luster from dull, or matte, through semi-gloss to high gloss, whereas high gloss is difficult to achieve with lacquers. Lacquers are likely to fail if frequently submerged in soapy solutions, as in kitchen utensils, for example, or if subjected to perspiration in handling, whereas synthetic varnishes and enamels that are highly resistant to such treatment are available. It is usually wise to select a reliable source of supply, and to follow the recommendations made by the manufacturer of the finish used, after stating all the requirements to be met in the product.

Let Us Have a Redistribution of Common Sense

"The visionaries of the present day have afflicted many of our people with the intellectual malady that causes them to believe that economic principles can be changed by legislative manipulation, an idea that is equally as impractical as the idea that the laws of nature can be controlled by congressional laws.

"A home market estimated between seventy-five and eighty-five billion dollars, providing work for almost everyone, awaits the restoration of the confidence of the investing public and business leaders of the nation. Colonel Leonard Ayers, the noted statistician, states: 'The shortages in the output of industrial goods that have accumulated during the depression amount to the complete normal output of all the durable goods industry for two and one-half years. In order to make up for that shortage, those industries will have to operate 25 per cent above their normal rates of active production for the next ten years. In other words, in order to catch up to normal, it will take 25 per cent more men and women working every day for the next ten years than were required by the peak production years of 1927, 1928, and 1929.'

"This work is held back because of political interference; many of our laws now in effect, and those proposed, are not intended to help the 95 per cent who are honest, but to put the same straightjacket on them that we put on the 5 per cent who are dishonest. We are killing the goose that laid the golden egg.

"As a member of Congress, I am interested in improving the conditions of those who toil, but I feel that we have had enough theory, enough panaceas, and that it is high time for us to be practical. Restore man's right to that which he earns, which is the driving force that has created national vitality. Restore the integrity of the Government and its obligations by at least attempting to balance the national budget. Discontinue excessive and wasteful expenditures.

"The restoration of economic security for the American people depends not upon favors to any one class, nor upon a redistribution of wealth, but rather upon a 'redistribution of common sense.' "
—*From an address by Honorable Fred A. Hartley, Jr., Congressman from New Jersey*

* * *

A New Idea in Salesmen's Cards

A unique type of calling card has been issued to the salesmen of the L. J. Wing Mfg. Co., New York City. The card is of the same size as an ordinary calling card, but takes the form of a miniature catalogue. It illustrates and briefly refers to the firm's line of heating, ventilating, blower, and turbine equipment, and can be tucked away in the vest pocket by anyone interested.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Marking on Metal Toys

E. T.—A metal toy pistol is painted solid black and then lettered as shown in Fig. 1. We wish to fill the indentation in which the lettering is placed with white paint and then rub off the excess paint, so as to leave white letters standing out on the black background. The indentation is about 1/64 inch deep. Can anyone suggest a high-production method for accomplishing this that we could use to advantage instead of a hand operation?

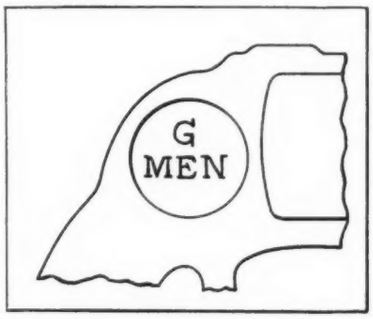


Fig. 1. Toy Pistol which is to be Marked with White Lettering

Answered by
Phil. E. Veraa
Richmond Hill
Long Island

The writer has seen marking of this kind done by a fast and efficient spraying method. The accompanying illustration, Fig. 2, shows how the indentation of the toy pistol may be located over a brass stencil plate *A* for marking by this method. The spray is operated by a foot pedal while the operator holds the work. The spray gun *B* is, of course, stationary. The channel *C* collects the surplus paint and allows it to drain off through the pipe *D*. This method has the one disadvantage that the stencil will not allow closed letters such as O, D, etc., to be marked completely because they must be bridged.

Fabricated Versus Cast Carburizing Boxes

C. R. H.—Is there any information available on the operating efficiency, length of life, and cost of cast carburizing boxes, as compared with carburizing boxes of welded steel construction? What is the best heat-resisting alloy for carburizing boxes?

A.—Cast boxes are heavier than boxes fabricated from rolled material. Except in the smallest sizes, the minimum limit of wall thickness for cast boxes is 3/8 inch, and many are 7/16 and 1/2 inch thick. The selection of boxes should take into account the heat absorbed in bringing the box up to the carburizing temperature each time it is used. Thus, while a thicker box may have a longer life than a lighter box, the greater amount of heat absorbed in bringing it up to the required temperature may offset the advantage of longer life. To make a fair comparison of costs between a light- and a heavy-weight box, it is necessary to consider the difference in weight between the two boxes, the cost of the material, the number of times the box must be brought up to operating temperature during its life, and the amount of heat required for this. Tests on welded and cast boxes are referred to in an article in MACHINERY, December, 1934, page 226.

Probably the best known of the heat-resisting alloys are those containing upward of 60 per cent nickel, with from 15 to 25 per cent chromium. The 25 per cent nickel, 20 per cent chromium alloy has given very good service in rolled material.

* * *

The most important problem now facing industry is the training of skilled men. In spite of unemployment figures, skilled men are scarce in many industrial centers. Most of the unemployed are unskilled in mechanical work.

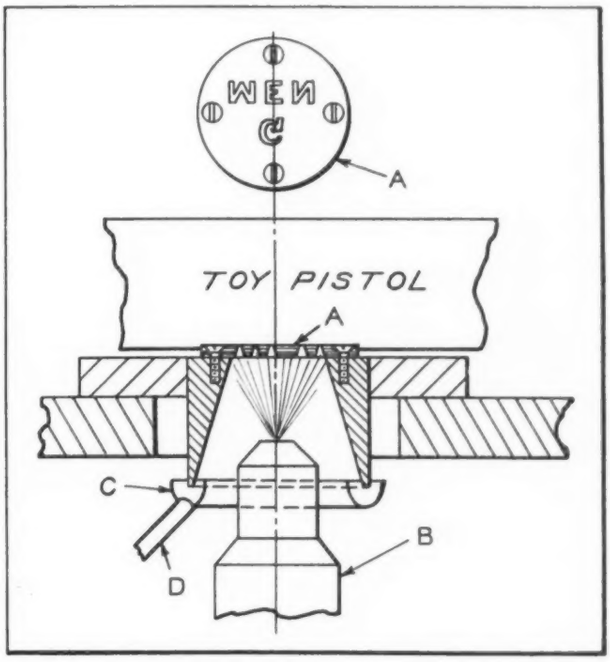


Fig. 2. Spray Nozzle of Paint Gun and Templet Arranged for Rapid Lettering on Toy Pistol

EDITORIAL COMMENT

Of recent years a practice in buying has been inaugurated by many industrial concerns—a practice that is considered highly objectionable by many men in the industries. While sometimes characterized by a term that would seem to commend it—"reciprocity in buying," it is a practice that in many instances leads to conditions that by no means enhance the friendly feelings suggested by the word "reciprocity."

Manufacturers who object to the practice say that all buying ought to be done on its merits and that no one should be asked to buy from his customer in order to make a sale. If his customer's goods are of the right quality and are offered at the right price, it should be possible to sell them on their merits, without using a "reciprocal" order as a club.

Reciprocal Buying is not Always to be Recommended

The practice does not make for friendly relations between manufacturers and their customers. It hurts the reputation of the manufacturer who insists upon reciprocal buying, and it ties the hands of both buyer and seller, preventing them from doing business on a basis where quality and price alone are the deciding factors. A sale made under what might be termed "forced conditions" is not likely to encourage repeat orders.

Engineers who have come to appreciate the remarkable possibilities of the metal-spraying process, often wonder why this process is not more widely known and used. The advantages that the method offers in many fields for building up worn parts and for producing corrosion-resistant and decorative coatings are obvious.

The Possibilities of the Metal-Spraying Process

The great value of metal spraying as a means of surface protection lies in the ease with which parts of considerable size or weight can be treated. To mention but one of scores of applications, the possibility of covering steel with a thin uniform coating of aluminum to resist corrosion at high temperatures will be appreciated by engineers in fields where this application will solve some perplexing problems. While iron may be covered with aluminum in other ways, where large structures are concerned, the convenience and economy of the spraying method, cannot be surpassed.

In the selection of the coating metal, a considerable choice is afforded, and if due regard is paid to the position of various elements in the electrochemical series, adequate protection of a metal against atmospheric and electrolytic corrosion can be secured. This, for example, emphasizes the importance of pure aluminum for coating steel surfaces, since aluminum is placed beyond both iron and zinc in this series.

Among the very latest developments in this process may be mentioned the efforts now being made to roll hard-facing alloys into fine wire, such as is required for feeding metal into the spray gun used for metal spraying. If these efforts are successful, it will be possible to increase the scope of the metal-spraying process greatly in applying hard-facing metal alloys.

Modern machine tools are capable of removing great amounts of metal efficiently; and many a shop superintendent points with pride to the new lathe, milling machine, or planer that takes deep heavy cuts without the slightest sign of distress.

Large Allowances for Finish are Wasteful

But why should it be necessary to remove so much metal? Most of these heavy cuts are required because the castings or forgings have too much metal left on them to be removed. Frequently there is something radically wrong with the work in the drafting-room, pattern shop, or tool-room, if the patterns or the dies leave so much metal for machining. These unnecessary machining allowances represent a great waste—a waste of metal, a waste of power, and a waste of time.

It is advisable, at intervals, to check up the dimensions of patterns and dies to find out if too much metal is being left for machining. As a rule, on castings an allowance of 1/8 inch for machining is adequate for ordinary purposes. On drop-forgings, an allowance of 1/16 inch should be enough, except in unusual and special cases. In fact, good forging practice permits even closer limits than 1/16 inch.

Ingenious Mechanical Movements

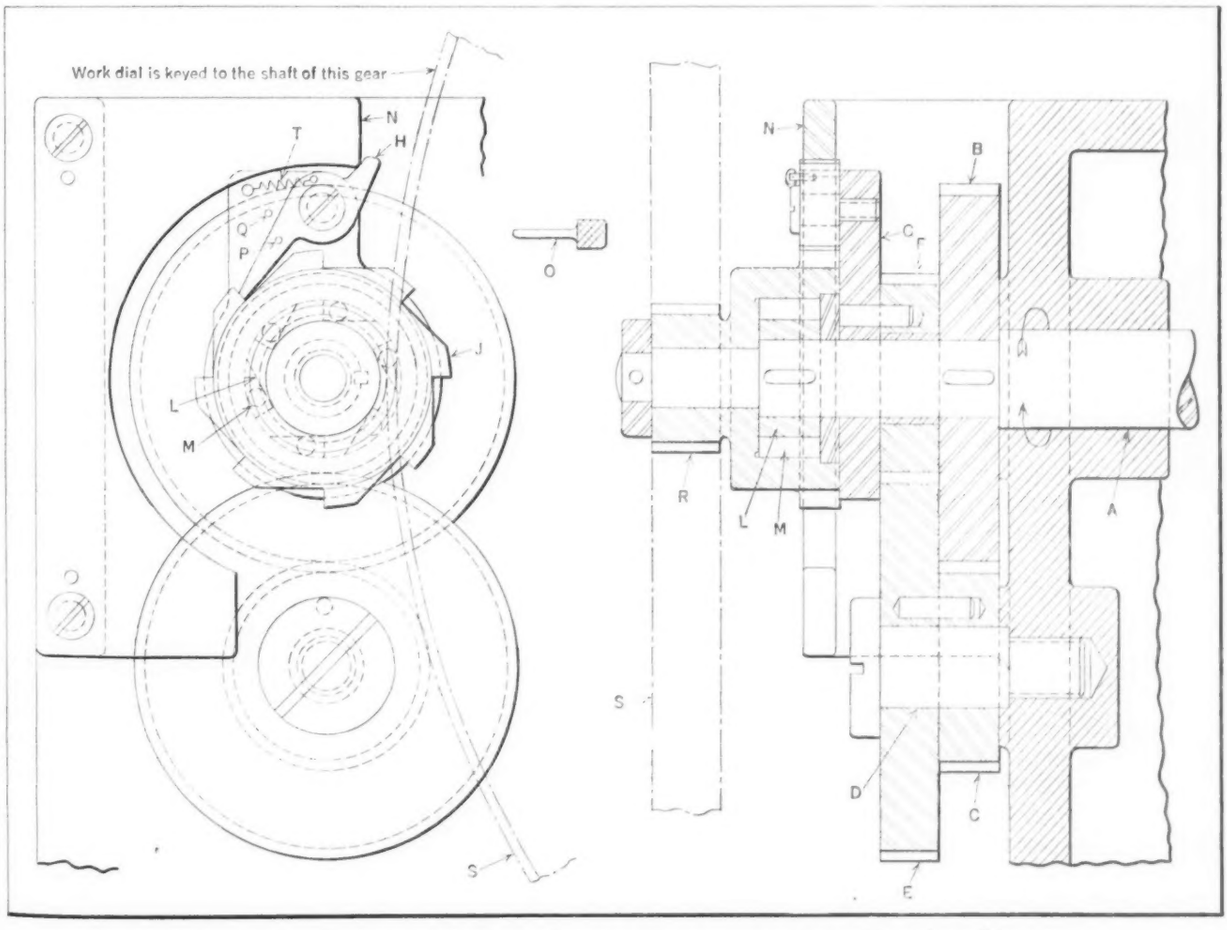
Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Combination Roller Clutch and Ratchet for Imparting Variable Rotary Movement

By J. E. FENNO

The over-running or "free wheeling" feature of roller friction clutches is used to advantage for imparting a variable rotary motion to the work-holding dial of a polishing machine. In connection with this movement, a ratchet and pawl is also employed. Similar pieces of two different diameters are polished on this machine. The work stations are so spaced that the large pieces will be close together on the dial, in order to reduce to a minimum the non-productive time of the wheel in passing from one piece of work to the other. However, the same dial and the same station spacing are employed for polishing the small-diameter work; hence, without the special variable-motion mechanism illustrated, an appreciable loss in production time would result, owing to the gaps between the work over which the wheel must pass.

With the mechanism shown, each station is advanced rapidly toward the polishing wheel until the polishing action commences. At this time, the rotary movement of the dial is immediately decreased to the desired speed. This speed of the dial continues until the part passes out of contact with the wheel, and the speed is then immediately increased, so that the succeeding dial station is moved rapidly



Variable-velocity Rotary-motion Mechanism for Work-carrying Dial of Polishing Machine

to the wheel. Provision is made for imparting a constant rotary movement to the dial when polishing the larger work.

The mechanism for imparting the variable dial movement is relatively simple. The dial is driven by the shaft *A*, which rotates at a constant velocity. On this shaft is keyed the gear *B*, meshing with gear *C* on stationary stud *D*. Gears *C* and *E* are pinned together, the latter meshing with gear *F*, which is free to turn on shaft *A*. Pinned to gear *F* and also free to turn on shaft *A* is the plate *G*, to which is pivoted the pawl *H*. This pawl intermittently engages the ratchet wheel *J*, its engagement being controlled by the stationary cam *N*. Wheel *J* turns freely on shaft *A*, and its left-hand end forms the pinion *R* for rotating the dial, the pinion meshing with the bull gear *S* secured to the back of the dial. The inside of the ratchet wheel is bored out to receive the roller clutch arrangement, which consists of the core *L* and rolls *M*. The core is keyed to shaft *A*.

The ratio of the gears *B*, *C*, *E*, and *F* is such that plate *G* rotates four times as fast as shaft *A*. Hence, owing to the over-running feature of the roller clutch, if pawl *H* is in engagement with the ratchet wheel, the dial will be rotated at high speed through gear *R*. However, provision is made for automatically disengaging the pawl just as the polishing wheel comes in contact with the work. This is accomplished by means of the cam *N*.

For example, the pawl is shown engaged, the dial having been rotated at high speed to advance the work to the wheel. With the ratchet wheel in the position indicated, the wheel is just about to come in contact with the work. As the plate *G* continues its rotary movement, the cam *N* swings the pawl out of engagement with the ratchet wheel, allowing the roller clutch to pick up the motion and continue the rotation of the dial at one-fourth the preceding angular velocity.

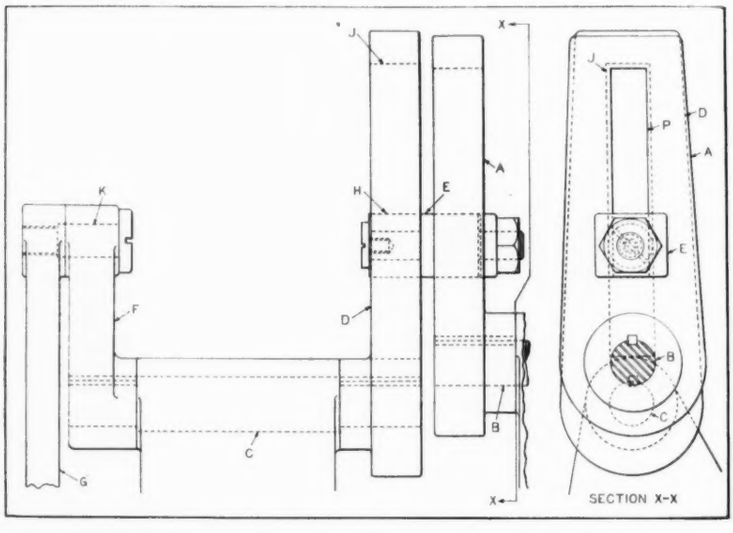


Fig. 1. Quick Return Crank Motion Mechanism with Means for Varying Velocity of Stroke

This new angular velocity is constant and continues until the polishing wheel has passed over and commences to leave the work. At this point, the pawl leaves the lower part of cam *N* and coil spring *T* forces it into engagement with the ratchet wheel, so that the high speed of the plate is once more transmitted to the ratchet, thus rotating the dial at a corresponding velocity to advance the next station toward the polishing wheel. In this way, the two driving members *G* and *L* alternately transmit the required speeds to the pinion gear *R*. Cam *N* is designed to hold the pawl out of engagement with the ratchet wheel for one-half revolution of gear *R*. Hence, since plate *G* rotates four times as fast as core *L*, the angular movement of gear *R* for one-half turn will be four times that for the remaining half turn of the cycle.

When the larger work is being polished, a constant angular velocity of the dial is required. To obtain this condition, the holes *P* and *Q* in the pawl and plate, respectively, are aligned, and the pin *O* is inserted through them. Thus, the pawl is held out of engagement with the ratchet wheel to allow the roller to transmit the constant rotary movement of shaft *A* directly to the gear.

It should be mentioned that there is sufficient friction in the various moving parts of the mechanism to prevent over-run of the roller clutch each time the pawl is disengaged. In applications where the inertia of the rotating part is likely to cause over-run, a simple brake can be mounted on one of the driving members.

This mechanism is designed to operate with the dial in a vertical plane, as the engagement of the rollers in the clutch is dependent upon gravity. However, the mechanism can be readily adapted to any other position of the clutch by inserting coil springs behind the rolls. Creeping movement of the clutch rolls in this unit does not accumulate and change the dial station location, since the creep for each cycle of the gear *R* is compensated for by the positive action of the ratchet.

Quick Return Crank Motion with Adjustment for Varying Velocity of Stroke

By F. E. JUDSON

Slotting machines, as a rule, are provided with some means of varying the cutting speed to suit the different materials to be machined. However, in reducing the cutting speed, the production is also reduced a corresponding amount, because the velocity of the entire cycle of the machine is slowed up. This objection was overcome in the case of one slotting machine by using a crank motion for actuating the slotting ram, the prin-

ciple of this motion being shown in Figs. 1 and 2. With this arrangement, the velocity of the working stroke can be varied within certain limits without changing the time taken for the ram to pass through its cycle. Therefore, varying the cutting speed of the tool in this way does not change the rate of production, because, as explained later, the loss in velocity during the working stroke is compensated for by increasing the velocity of the return stroke.

The crank mechanism consists chiefly of the arm *A*, Fig. 1, keyed to driving shaft *B;* the jack-shaft *C*, keyed to the arm *D* in which slides a cross-head *E* fastened to and adjustable along arm *A;* and crank *F*, also keyed to jack-shaft *C* and connected to the slotting ram by the connecting-rod *G*.

It will be noted that jack-shaft *C* is offset from the driving shaft *B*. Consequently, as arm *A* rotates arm *D* and crank *F*, the pivot block *H* on cross-head *E* slides back and forth in the slot *J*. Arm *D* and crank *F*, therefore, will be given an irregular rotary movement; that is, the crankpin *K* will travel faster in its circular path *S*, Fig. 2, when below the horizontal center line of shaft *C* than when above this center line. This action will be more clearly understood by referring to Fig. 2. Here let circle *L* represent the path of cross-head *E*, point *M* indicating the center of driving shaft *B*. Let *N* indicate the center of shaft *C*, and let the heavy line represent the arm *D* with the cross-head at *O*.

Now, if the arm *D* is horizontal, as indicated by the heavy line, the cross-head, with arm *A* and shaft *B*, will rotate in the direction of the arrow only 160 degrees, in order to rotate arm *D* one-half revolution. Thus, during this movement, which corresponds with the return stroke of the ram, arm *D* and crank *F* rotate faster than arm *A*. In completing their revolution, however, the cross-head and arm *A* rotate 200 degrees to turn arm *D* and the crank the remaining half revolution. Hence, during the latter movement, which corresponds with the working stroke of the ram, crank *F* rotates more slowly than arm *A*. Thus, a slow working stroke and a rapid return stroke are obtained.

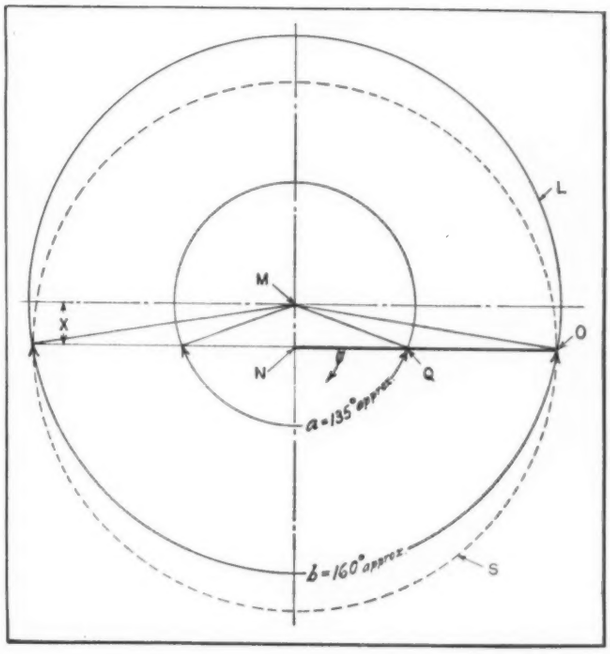


Fig. 2. Diagram Indicating Operating Principle of Mechanism Shown in Fig. 1

If it is required to reduce the velocity of the working stroke, the cross-head is adjusted inward in slot *P*, Fig. 1, to a new position, say, to *Q*, Fig. 2. In this case a 135-degree movement of arm *A* is required to rotate crank *F* through its return stroke, and a 225-degree movement to rotate the crank through its working stroke. Thus, the velocity of crank *F* is increased during the return stroke and reduced during its working stroke. Crank *F* and arm *A*, however, complete their cycle in the same time, so that the reduction in velocity of the working stroke does not affect the production rate of the machine.

Incidentally, a greater range in the velocity variation of the crank can be obtained by increasing the offset *X* between shafts *B* and *C*. This change will, of course, affect the length of the slots in the arms.

A Swiss Cupping-Test Machine

AMONG the mechanical tests used for determining the quality of sheet metal, the cupping test, although comparatively new, has been fairly widely adopted in industry, owing to the ease with which it can be carried out and because of the fact that it is reasonably dependable. While the test, as pointed out in a recent issue of *Engineering*, has its limitations, it yields so much useful information that there is an increasing demand for equipment by which it may be performed.

A testing machine for this purpose has been placed on the market by Alfred J. Amsler & Co. of Schaffhausen, Switzerland. The machine consists mainly of a cylindrical body having an opening in its upper end through which the strips or disks of sheet steel to be tested are passed. When the specimen of sheet metal has been introduced and clamped in position, its thickness is read off in millimeters on an indicator and in fiftieths of a millimeter on a scale engraved around the circumference of the clamping screw. Gradations as close as one-hundredth of a millimeter are said to be readily estimated. Another indicator connected to the cupping tool enables the depth of the cup to be ascertained in tenths of a millimeter. The load applied is measured by a pressure gage.

Engineering News Flashes

The World Over

Measuring the Expansion of Metals to 0.0001 Inch

In the Schenectady Works Laboratory of the General Electric Co., there is a dilatometer, an instrument that measures and records in ten-thousandths of an inch the expansion and contraction of metals as they are heated and cooled. The device was built from specifications of the United States Bureau of Standards for use by the company in its investigations regarding metals.

The dilatometer consists of a small cylindrical furnace surrounding a quartz tube, the quartz withstanding high temperatures and having a minimum of expansion when heated. A round core of about the size of a thick pencil and made of the metal to be tested is placed within the tube, which is then heated electrically to 1800 degrees F. On top of the specimen is placed another smaller quartz tube, sealed at both ends, to transmit the dilation of the test piece to a dial gage. The gage is connected by an Invar clamp to the outside quartz tube.

The World's Longest Bridge

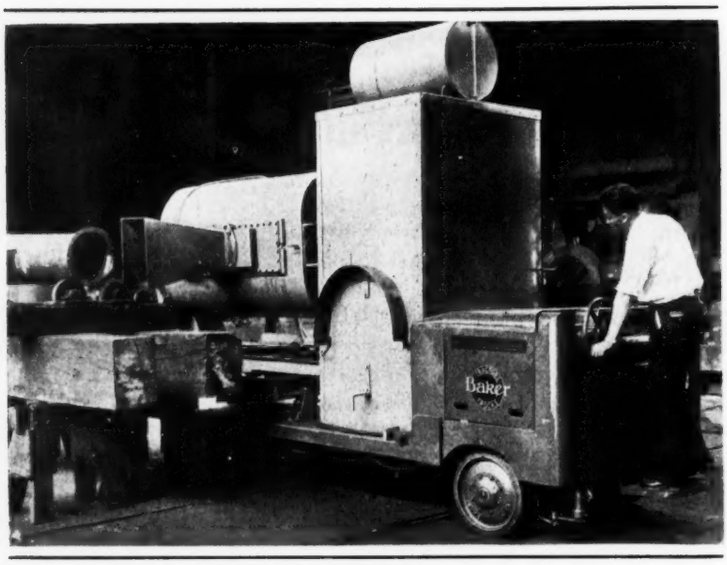
The bridge across the San Francisco Bay, connecting San Francisco and Oakland, will be the world's longest bridge. The actual bridge is 4 1/2 miles long without the approaches; with the approaches, it will measure 8 1/4 miles. It has been under construction since July, 1933, and it will not be completed until 1937. It is a double-deck structure, with six lanes on the upper deck and two lanes for trucks, besides two sets of electric car tracks, on the lower deck. The super-steel structure will involve an expenditure of about $22,500,000.

Increasing Use of Oil Engines at Sea

In 1914, ships aggregating 220,000 tons were equipped with internal combustion engines. Today there are 5511 ocean-going vessels aggregating 11,300,000 tons propelled by engines of this type.

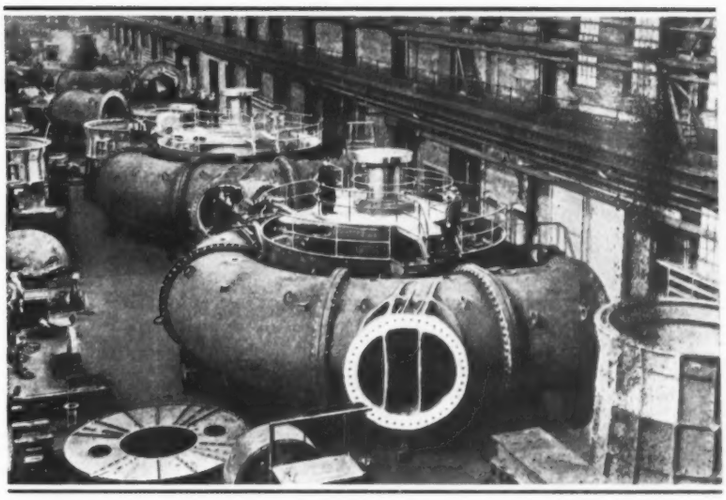
A New Aluminum Alloy

From Scotland comes the news of a new aluminum alloy "Pistonel," developed by J. H. Ballantyne, 104 Ormonde Ave., Muirend, Glasgow, for which remarkable properties are claimed. The new alloy is said to have nearly twice the strength of ordinary aluminum, to be highly resistant to high temperatures and corrosion, and to have a



When welds are to be inspected by X-ray apparatus in large boilers and other pressure vessels, it is awkward to move the object to be inspected to suit the position of the X-ray equipment. A portable X-ray outfit is almost a necessity. The illustration shows General Electric X-ray equipment mounted on a Baker truck, recently purchased by a well-known manufacturer. The truck has a platform nearly 12 feet long by 5 feet wide, to which the X-ray equipment is securely bolted.

The illustration shows four 115,000-horsepower hydraulic turbines for the Boulder Dam power development which were constructed in the shops of the Allis-Chalmers Mfg. Co., Milwaukee, Wis.



coefficient of expansion almost equal to that of cast iron. Obviously, it has a low specific gravity. It is close-grained and easily machined, cast, forged, rolled, extruded, or welded. It also takes a high polish. This new aluminum alloy is recommended for motor car and aircraft parts; if all that is claimed for it materializes in practical application, it should have great value in the mechanical industries in general.

Speeding Up Tin-Plate Production

A recent number of *Industrial Britain* mentions that experiments have been carried out at the Old Castle Tin-Plate Works at Llanelly, Wales, through which a process has been discovered which, it is claimed, will speed up production in the tin-plate industry and materially lower costs. It is stated that the process will enable a finished tin plate, ready for packing, to be produced in twenty-four hours, as compared with from ten to fourteen days with present production methods.

The Machine Promises to Revolutionize Cotton Picking

Since the advent of the cotton-ginning machine, hand picking of cotton has been the "neck of the bottle" in the cotton industry. It has handicapped the cotton grower and has greatly retarded the use of tractors and power farming generally throughout the cotton belt. A new machine known as the "Rust Cotton Picker" promises to change this condition. It has been stated that this machine will be able to pick cotton at one-tenth of the cost of hand picking; but this saving is not the only one claimed for the new equipment. The longer the cotton remains in the field after maturity, the more it deteriorates. The sooner it is picked, the better the quality of the cotton and the higher the price paid for it.

The cotton-picking machine consists primarily of an endless belt carrying several hundred smooth wire spindles. As it passes over the row of cotton, the rotating spindles, which have been automatically moistened, wrap the cotton around them without damaging the plants. After this, the cotton is stripped from the spindles and delivered by a suction fan to a container. The machine has been developed by the Southern Harvester Co., Memphis, Tenn.

Engineering Invades Paint-Brush Field

A new type of paint brush has been developed by the Pilgrim Fountain Paint Brush Corporation, of New York City, that is said to mark a revolution in the manufacture of paint brushes and in the painting field. The new brush is made entirely of aluminum and uses a felt applicator in place of the usual hair bristles. The brush is so constructed that the handle also serves as a reservoir for the paint. Furthermore, the construction is such that any number of the brushes can be attached to a rod and as many colors as desired can be painted at one stroke of the arm. On jobs requiring a large quantity of paint, a tube and pump arrangement can be attached to the paint brush, enabling the pumping of a continuous flow of paint into the handle reservoir of the brush.

British Roller-Bearing Locomotive

The new turbine-driven locomotive recently put in service by the London, Midland & Scottish Railway Co. is provided with tapered roller bearings made by British Timken, Ltd., Birmingham, England. This, we are told, is the first time that a British locomotive has been fully equipped with roller bearings on all axles. All together, twelve single-row and eight two-row bearings are used to carry the complete locomotive and tender.

How to Construct a Logarithmic Chart

A Detailed Description of the Making of Alignment Charts with Several Variables

By W. F. FISCHER

THE value of alignment charts to facilitate engineering calculations is too well recognized by engineers to require emphasis. Alignment charts representing a specified formula (frequently referred to as logarithmic charts) are often published in technical journals. The purpose of the present article is to describe briefly the steps required in making an alignment chart having parallel axes, with three and four variable quantities. With a little practice, anyone familiar with ordinary mathematics can easily learn how to chart his own formulas in a similar manner.

In order to illustrate the steps required in charting an equation involving four variables, take as an example the formula:

$$d = \sqrt[3]{\frac{321{,}000\ H.P.}{nS}} \qquad (1)$$

This formula gives the diameter d of a solid shaft required to transmit a given horsepower ($H.P.$), when revolving at n revolutions per minute. In the formula:

d = diameter of shaft, in inches;
$H.P.$ = horsepower to be transmitted:
n = number of revolutions per minute; and
S = allowable torsional shearing stress, in pounds per square inch.

This formula will be found on page 491 of MACHINERY'S HANDBOOK, Ninth Edition.

Formula (1) can be written in the form:

$$H.P. = \frac{nSd^3}{321{,}000} \qquad (2)$$

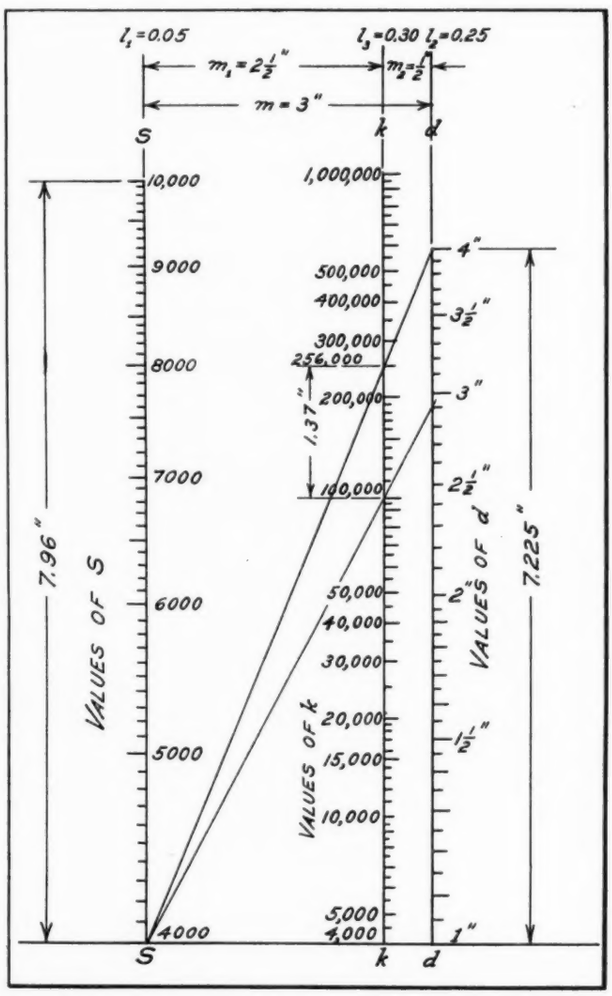


Fig. 1. Alignment Chart which Involves Three Variable Quantities

By taking logarithms of both members of (2)

$$\text{Log } H.P. = \text{Log } n + \log S + 3 \log d - \log 321{,}000 \qquad (2a)$$

Let it be required to chart Formula (2) for values of n ranging from 100 to 600 revolutions per minute; values of S ranging from 4000 to 10,000 pounds per square inch; and shafts ranging from 1 inch to 4 inches in diameter.

Then, for the range of values given, we note that log n varies from log 100 = 2, to log 600 = 2.77815; or a logarithmic range of 0.77815; log S varies from log 4000 = 3.60206, to log 10,000 = 4; or a logarithmic range of 0.39794. Likewise, log d varies from log 1 = 0, to log 4 = 0.60206; or log d^3 varies from 3 × log 1 = 0, to 3 × log 4 = 1.80618, giving a logarithmic range for d^3 equal to 1.80618.

The logarithms used in this article are taken directly from the logarithmic tables in MACHINERY'S HANDBOOK.

Since we cannot chart more than three variables in each step of the process, transpose Formula (2) to this form:

$$Sd^3 = \frac{321{,}000\ H.P.}{n} \qquad (3)$$

Taking logarithms of both members of (3), and assuming each member equal to log k, we have:

$$\text{Log } S + 3 \log d = \text{Log } k \qquad (4)$$

$$\text{Log } 321{,}000 + \log H.P. - \log n = \text{Log } k \qquad (5)$$

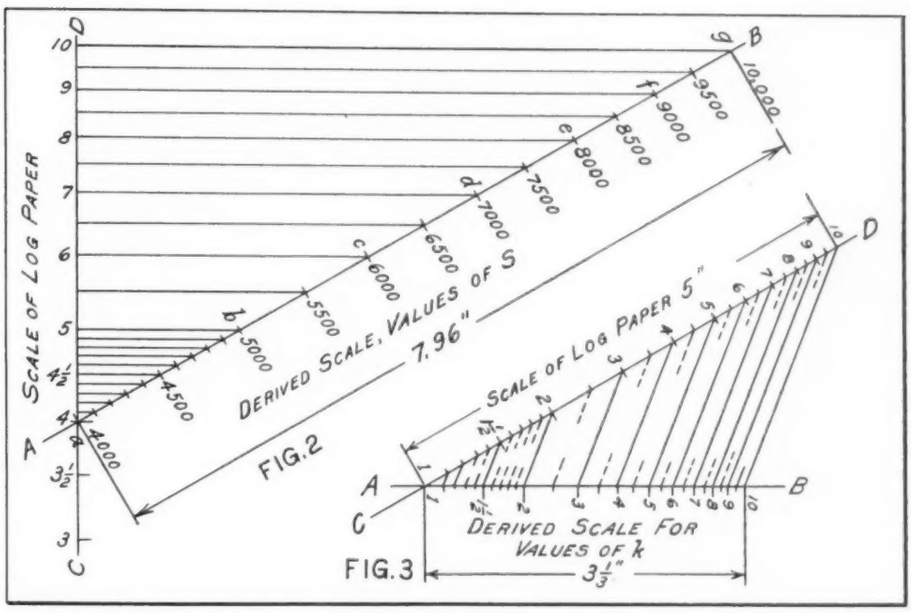
We can then chart Equation (2) in two steps of three variables each.

Equation (4) can be charted for the three variables S, d, and k, as indicated in Fig. 1, by placing the axis of k somewhere between the axes of n and d.

If we desire to limit the graduated length of the axes to, say, 8 inches or less, we must select a suitable scale

Fig. 2. Method of Graduating the S Axis

Fig. 3. Method of Laying out Reduced Logarithmic Scale for Values of k



value for each axis. Let these scale values be represented by l_1 for the S axis; l_2 for the d axis; and l_3 for the k axis.

To find approximate values for l_1, l_2, and l_3, divide the given logarithmic range for each variable by 8; then,

For the axis of S, $l_1 = 0.39794 \div 8 =$ say, 0.05;
For the axis of d, $l_2 = 1.80618 \div 8 =$ say, 0.25.
Then

$$l_3 = l_1 + l_2 = 0.05 + 0.25 = 0.30$$

Taking $l_1 = 0.05$, the measured length of the S axis from the graduation mark for $S = 4000$ to the mark for $S = 10{,}000$ is $0.39794 \div 0.05 = 7.96$ inches.

Taking $l_2 = 0.25$, the measured length of the d axis from the mark representing $d = 1$ to the mark for $d = 4$ is $1.80618 \div 0.25 = 7.225$ inches.

In the finished chart correlating the four variables n, S, d, and $H.P.$, the axis of k is used simply as a "supporting axis" and need not be graduated. For the purpose of illustrating a chart with only three variables, however, this axis will be graduated as explained below.

Locating and Graduating the Axes

Having decided upon the scale values l_1 and l_2 for the axes of S and d, respectively, we are now ready to locate the axes with reference to the third axis k. Referring to Fig. 1, ratio $m_1 \div m_2$ must equal the ratio $l_2 \div l_1$ or:

$$\frac{m_1}{m_2} = \frac{l_2}{l_1} = \frac{0.25}{0.05} = 5$$

Therefore, since $m_1 = 5 \times m_2$, we can place the d axis, say, 1/2 inch to the right of the k axis ($m_2 = 1/2$); and the S axis $5 \times 1/2 = 2\ 1/2$ inches to the left of the k axis ($m_1 = 2\ 1/2$).

We are now ready to graduate the axes, which may be done most simply by using a suitable logarithmic scale, such as the scale on a slide-rule, or by using logarithmic paper, which is available in almost any stationery store handling draftsmen's supplies. This paper can be obtained graduated from 1 to 10 in a length of 5 inches, and also in a length of 10 inches.

The S axis is to be graduated from 4000 to 10,000 in a length of 7.96 inches. Using a sheet of logarithmic paper ruled from 1 to 10 in a length of 10 inches, the S scale can be graduated by the method shown in Fig. 2.

The graduations of the logarithmic paper are shown on the line CD, the graduated length from 4 to 10 being 3.95 inches, approximately. Draw the line AB in such a manner that the length from a to g is 7.96 inches. This line cuts the ruled lines on the logarithmic paper from 4 to 10 at the points a, b, c, d, e, f, and g; the point a coincides with 4 on the logarithmic scale; b with 5 on the logarithmic scale; c, with 6, etc.

Point a on the derived scale is marked 4000; b, 5000; c, 6000; etc. Intermediate graduations such as those between a and b, are put in on the derived scale in a similar manner, as shown.

The graduations representing the values of S obtained in this manner from the logarithmic paper can then be transferred directly to the S axis of Fig. 1.

The axis d can then be graduated in a similar manner for values of d ranging from 1 to 4, as shown. To make this scale in a length of 7.225 inches, point a on the derived scale, Fig. 2, is connected with 1 on the logarithmic paper, and point g with the ruled line representing the value 4; the measured length from a to g in this case being 7.225 inches. Care should be taken to mark the graduations as accurately as possible, using a sharply pointed pencil for the purpose.

Assuming that the k axis, Fig. 1, is to be graduated also (not required in the completed chart),

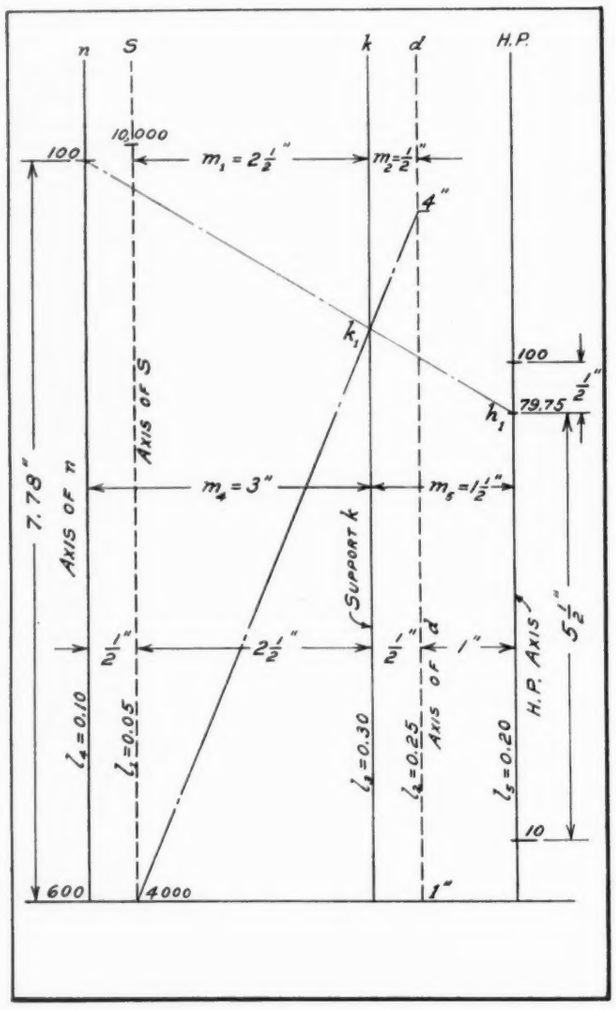


Fig. 4. Diagram Illustrating Method of Graduating the H.P. Axis

a starting point may be found by connecting 4000 on the S axis with 4 inches on the d axis. A straight line connecting these two points cuts the k axis in graduation $k = 256{,}000$, determined as follows: By Equation (4),

$$\text{Log } S + 3 \log d = \text{Log } k \quad \text{or}$$

$$\text{Log } 4000 + 3 \log 4 = 3.60206 + 1.80618 = 5.40824 = \log k; \text{ hence, } k = 256{,}000$$

It is simpler, however, to start the graduation of the k axis from the marking for $k = 100{,}000$. This mark will be located 1.37 inches below the mark for $k = 256{,}000$; that is,

$$\frac{5.40824 - 5}{0.30} = 1.37$$

in which 5.40824 is the logarithm of 256,000; 5, the logarithm of 100,000; and 0.30, the scale value l_3 for the k axis, as given in the foregoing.

When $S = 4000$ and $k = 100{,}000$, then

$$3 \log d = \log k - \log S = 5 - 3.60206 = 1.39794$$

$$\text{Log } d = 1/3\ (1.39794) = 0.46598, \text{ and}$$

$$d = 2.924 \text{ inches}$$

A straight line connecting 4000 on the S axis with 100,000 on the k axis will, if extended to the d axis, cut that axis at graduation $d = 2.924$. It should be noted that the graduations on the d axis are actually those representing values of 3 log d (or d^3), but that they are read off as values d and not d^3.

We are now ready to graduate the k axis, starting at graduation 100,000, which is 1.37 inches below the marking for $k = 256{,}000$. A scale for the k axis may be prepared as shown in Fig. 2 and already explained for the S axis. In this case, however, note that when $S = 4000$ and $d = 1$, the least value of k is $k = S \times d^3 = 4000 \times 1 = 4000$, or log k = log 4000 + 3 log 1 = 3.60206 + 0 = 3.60206, and $k = 4000$.

Similarly, when $S = 10{,}000$ and $d = 4$, the greatest value of k required is $k = 10{,}000 \times 64 = 640{,}000$, or log k = log 10,000 + 3 log 4 = 5 + 1.80618 = 6.80618, and $k = 640{,}000$.

It is easy to graduate the k axis by preparing a logarithmic scale ranging from 1 to 10 in a length of

$$\frac{\log 10 - \log 1}{l_3} = \frac{1 - 0}{0.30} = 3\ 1/3$$

The k axis may then be graduated from the 100,000 mark already located (Fig. 1), both upward and downward as shown, using the derived scale and repeating as required.

The method of preparing this reduced logarithmic scale from 1 to 10 in 3 1/3 inches is shown in Fig. 3, where CD is the original scale on the logarithmic paper and AB is a line drawn through graduation 1 on that scale at any suitable angle. Measure off a length of 3 1/3 inches on AB; connect 10 on CD with 10 on AB and draw the other lines representing the intermediate graduations parallel to this line.

The chart Fig. 1 correlates the three variable quantities S, d, and k according to the equation $S \times d^3 = k$ or log S + 3 log d = log k.

Given any pair of values of S and d, the corresponding value of k may be found by connecting the given value of S with the given value of d; where the line intersects the k axis, read off the corresponding value of k. If S and k are the given values, then connect S and k; where the line extended cuts the d axis, read off the corresponding value of d. In the same way, if d and k are given, connect the d and k values at the proper graduations, extend the line to the S axis, and read off the value of S.

Completing the Chart

Fig. 1 represents the first step of the process required to chart Equation (2) or (2a), except that the k axis need not be graduated in the completed chart, since it acts simply as a "supporting" axis for the others. This first step of the process consists in locating the S, k, and d axes with reference to one another, and graduating the S and d axes as shown. In the second step, we locate and

graduate the n and $H.P.$ axes with reference to the k axis so as to satisfy the equation

$$\frac{321{,}000\,H.P.}{n} = k \qquad \text{or}$$

$$\text{Log } 321{,}000 + \log H.P. - \log n = \log k \quad (5)$$

This last equation can be charted, according to the methods shown in Fig. 4, by placing the $H.P.$ axis to the right of the k axis and the n axis to the left of the k axis.

Since we wish to limit the length of the axes to 8 inches or less, we must select the proper values l_4 for the n axis and l_5 for the $H.P.$ axis.

Since the values of n are to vary from 100 to 600, or log n from 2 to 2.77815, the logarithmic range is 0.77815; then $0.77815 \div 8 = 0.097$. Hence, if we choose $l_4 = 0.1$, the graduated length of the n axis from graduation 100 to graduation 600 will be $0.77815 \div 0.1 = 7.78$ inches.

The n axis must then be graduated from $n = 100$ to $n = 600$ in a length of 7.78 inches, but since log n is preceded by a minus sign, the n axis must be graduated downward instead of upward, beginning with 100 at the top as shown.

The $H.P.$ axis is m_5 units to the right of the k axis, and the n axis, m_4 units to the left of the k axis.

Now $l_4 + l_5 = l_3$, hence $l_5 = l_3 - l_4 = 0.3 - 0.1 = 0.2$, where l_3 is the scale value for the axis of k; l_4, the scale value for the axis of n; and l_5, the scale value for the axis of $H.P.$ Then

$$\frac{m_4}{m_5} = \frac{l_5}{l_4} = \frac{0.2}{0.1} = 2; \text{ and } m_4 = 2m_5$$

Hence, if m_5 is made equal to 1 1/2 inches, m_4 equals 3 inches.

We now have the d axis located 1/2 inch to the right of the k axis; the $H.P.$ axis 1 inch to the right of the d axis, or 1 1/2 inches to the right of the k axis; the S axis 2 1/2 inches to the left of the k axis; and the n axis 1/2 inch to the left of the S axis, or 3 inches to the left of the k axis, and graduated in the opposite direction to the other axes. The k axis is not graduated. The finished chart will appear as in Fig. 5. We still have to graduate the $H.P.$ axis as shown in that figure.

Graduating the Axis for the Horsepower

To find a starting point for the graduation of the $H.P.$ axis, we connect 4000 on the S axis with 4 on the d axis, as shown in Fig. 4, and mark a point k_1 on the k axis; then connect 100 on the n axis with k_1, extend the line to the $H.P.$ axis, and mark the point h_1 on that axis. The value of $H.P.$ at point h_1 is obtained from Equation (2a):

$$\begin{aligned}\text{Log } H.P. &= \text{Log } n + \log S + 3 \log d - \log 321{,}000 \\ &= \text{Log } 100 + \log 4000 + 3 \log 4 - \log 321{,}000 \\ &= 1.90173. \quad \text{Hence } H.P. = 79.75 \text{ at } h_1.\end{aligned}$$

It is much simpler, however, to start the graduation of the $H.P.$ axis from the mark for $H.P. =$ 100, or log 100 = 2. This mark for 100 H.P. is located a distance 0.491, or approximately 1/2 inch above the point h_1 for 79.75 H.P. This is determined as follows:

$$\frac{\log 100 - \log 79.75}{l_5} = \frac{0.09827}{0.2} = 0.491$$

The $H.P.$ axis is graduated by a logarithmic scale reading from 1 to 10, or from 10 to 100 in a length of 5 inches, since

$$\frac{\log 10 - \log 1}{0.2} = \frac{\log 100 - \log 10}{0.2} = 5$$

This logarithmic scale can then be used to graduate the $H.P.$ axis above and below the mark for 100 H.P. by putting in the proper values for the graduations thus located, as shown in Fig. 5. The values given on the $H.P.$ axis are from 5 to 500 inclusive, but if the full range of the chart is to be utilized, the graduations can be extended as desired.

The following examples will illustrate the method of reading the chart and will serve as a check on the accuracy of its construction.

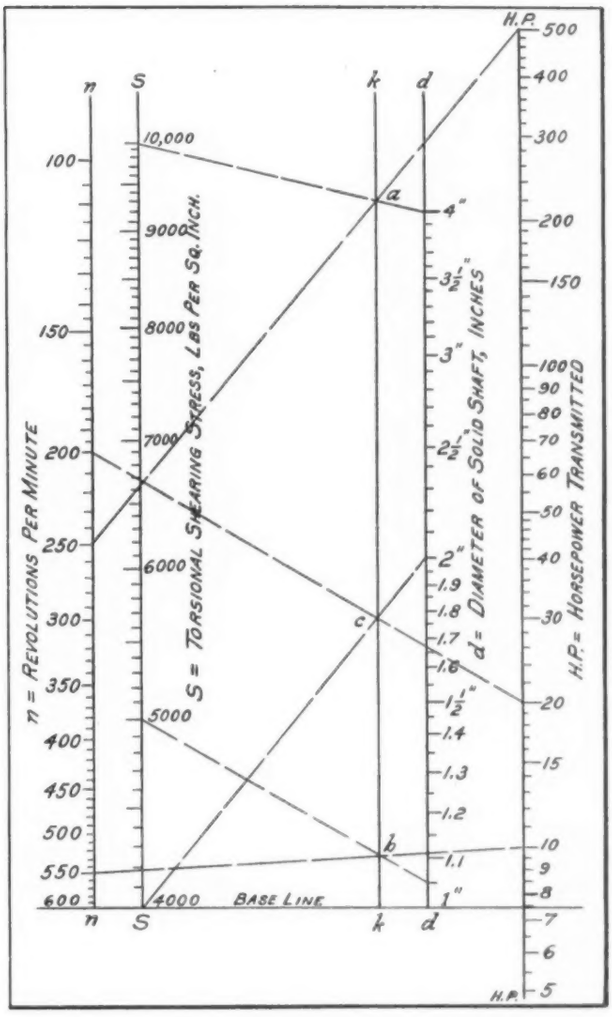


Fig. 5. Completed Alignment Chart Involving Four Variable Quantities

Example 1—Given the values $S = 10{,}000$; $d = 4$; and $n = 250$; find the horsepower transmitted.

Connect 10,000 on S, Fig. 5, with 4 on d, the line cutting the k axis at point a; connect 250 on n with point a on k, extend to the *H.P.* axis, and read off 500 horsepower, approximately.

To check this by Equation (2a):

$$\text{Log } H.P. = \text{Log } 250 + \log 10{,}000 + 3 \log 4 - \log 321{,}000$$

$$= 2.39794 + 4 - 1.80618 - 5.50651 = 2.69761$$

Hence, $H.P. = 498.4$, approximately.

Example 2—Given $H.P. = 10$; $S = 5000$; $n = 550$; find the diameter of the shaft d.

Connect 10 *H.P.* with 550 on n, marking point b on k axis; connect 5000 on S with the point b on k; extend to axis d and read off 1 inch, approximately, as the diameter of the shaft.

To check this, we have, by transposition of Equation (2a),

$$\text{Log } d = 1/3 \ (\log H.P. + \log 321{,}000 - \log n - \log S)$$

$$= 1/3 \ (\log 10 + 5.50651 - \log 550 - \log 5000)$$

$$= 1/3 \ (0.06718) = 0.02239$$

Hence, $d = 1.05$ inch diameter

Example 3—Given $H.P. = 20$; $n = 200$; $d = 2$; find S in pounds per square inch.

Connect 20 *H.P.* with 200 on n, marking point c on the k axis; connect 2 on d with point c on k, extend to the S axis, and read off $S = 4000$, approximately.

From Equation (2a) we have:

$$\text{Log } S = \text{Log } H.P. + \log 321{,}000 - \log n - 3 \log d$$

$$= \log 20 + 5.50651 - \log 200 - 3 \log 2$$

$$= 3.60342$$

Hence, $S = 4012$

In making an alignment chart similar to that shown for a given formula, it should be checked thoroughly with several examples before being used. This method of checking will show any errors in the construction.

Any equation such as

$$x^{0.9} = u^{-1.6} \times v^{2.1} \times 0.6w^{1.5}$$

which can be written in the form

$$0.9 \log x = 2.1 \log v + \log 0.6 + 1.5 \log w - 1.6 \log u$$

can be charted with the axes parallel as in Fig. 5. The last equation can be written

$$0.9 \log x + 1.6 \log u = \log k$$

$$2.1 \log v + \log 0.6 + 1.5 \log w = \log k$$

Any other transposition in the original equation may be made as desired. The equation is then charted in two steps of three variables each.

If the transposition in the original equation is made as follows:

$$\frac{x^{0.9}}{v^{2.1}} = \frac{0.6w^{1.5}}{u^{1.6}} = k$$

or

$$0.9 \log x - 2.1 \log v = \log 0.6 + 1.5 \log w - 1.6 \log u = \log k$$

the v and u axes will be graduated in the opposite direction to the other axes, similar to the n axis of Fig. 5.

* * *

Savings by Copper-Brazing Process

Through the use of a small General Electric batch type electric furnace for copper brazing, in a controlled atmosphere, more than 150 machine parts for adding and accounting machines, the Dalton-Powers Division of Remington Rand, Inc., Norwood, Ohio, has been making substantial savings in production and service costs. It is stated that the strength, quality, and life of the parts has been materially improved by the new process. Four of the parts provide good examples of the advantages offered by the electric furnace method of brazing.

When the "tubular subtraction wheel" was fabricated by riveting, it was the source of many service complaints. Now, spotted in position and electric-furnace brazed, its strength is materially increased. There are no rivets to come loose, and service costs are cut.

Formerly, the "total link arm" was stake-pinned and torch-brazed. The driving force necessary in pinning often changed the slot dimensions. Now, the part is press-fitted and electric-furnace brazed, with the result that time is saved and strength increased.

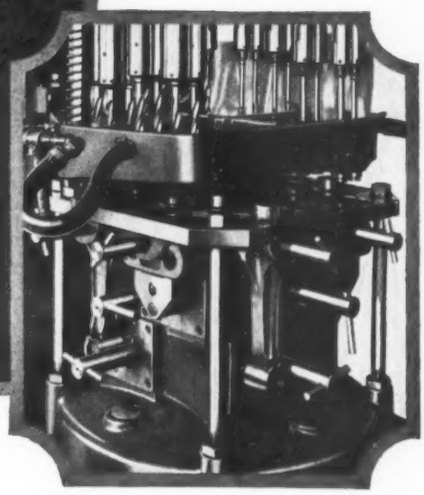
The "handle hub and driving arm" assembly was formerly held together by four riveted pins which sometimes loosened and caused service complaints. The parts of the assembly are now press-fitted, spotted, and electric-furnace brazed. As a result, rejects are entirely eliminated and service costs reduced.

The "handle drive shaft" assembly, previously spot-welded and torch-brazed, is now press-fitted in position and electric-furnace brazed. The vibration and severe impacts that these parts have to withstand in everyday service sometimes worked the joints loose and made replacements necessary. With the electric-furnace-brazed assembly, the strength is greatly increased and there are no complaints about vibration-loosened joints.

* * *

Cost figures are frequently misleading because in many plants the "overhead" is still a very vague and elusive conception.

Design of Tools and Fixtures



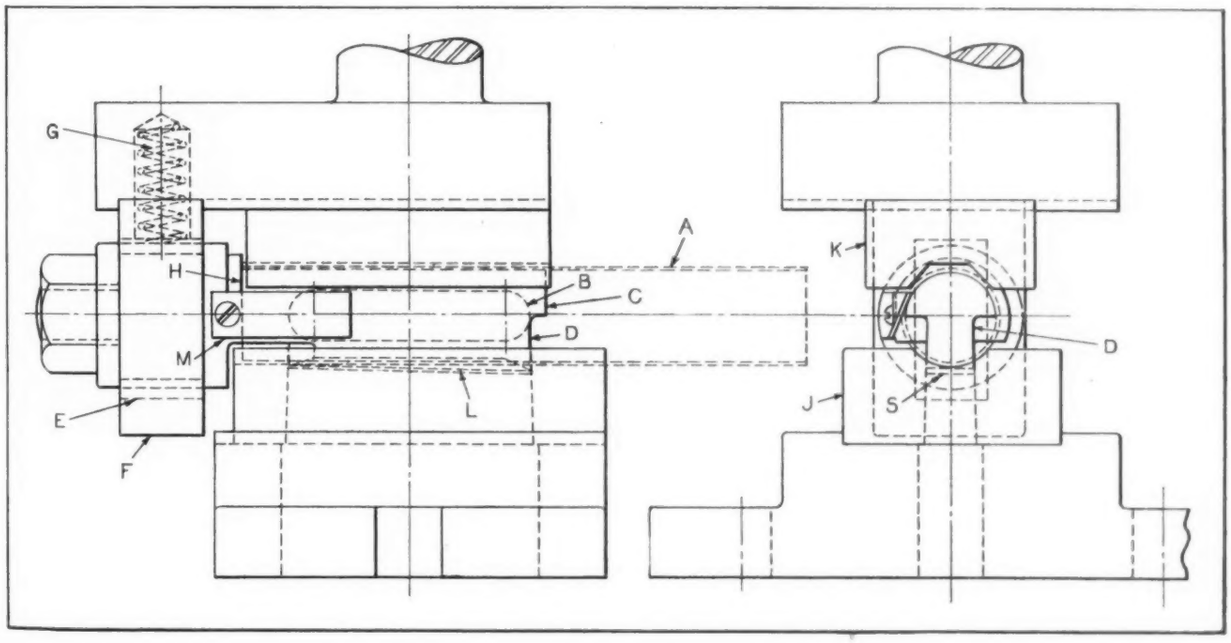
Die for Punching Four Equally Spaced Slots in Tubing

By BEN CLARK, Newark, N. J.

When only a few tubes like the one shown at *A* in the accompanying illustration were needed, the four slots *B* were milled on a hand milling machine. A good job was obtained in this way, but the method was rather slow. When it became necessary to supply the tubes in large quantities, the die illustrated was developed. The punch and die are shown in the closed position. with slug *S* punched from the tubing. The slots are 90 degrees apart.

The Shelby steel tubing *A* has an outside diameter of 1 inch, an over-all length of 15 inches, and a wall thickness of 1/32 inch. The horn *C* is made integral with the punch *D*. The rear end of the horn is a sliding fit in slot *E* in the guide block *F*, which is fastened in a recess in the punch-holder. When the punch and die are open, spring *G* forces the horn *C* to the lower end of the slot *E*. This permits the tube *A* to be placed on the horn and pushed back against the shoulder *H*.

When the press is tripped, the horn and the tube are carried down until the tube is located in the die-block *J*. Further downward movement of the punch-holder brings the V-block *K* into contact



Horn Type Die Used for Punching Four Slots B in Tube A

with the tube and forces the punch *D* through the lower wall. The punch has an angular face at *L*, which gives a shearing cut. When the punch and die are opened, the unsupported end of tube *A* is moved up and down a few times until the natural springiness of the metal strips the tube from the punch.

The tube is now rotated clockwise until the edge of the slot passes the flat spring locating stop *M*. It is then turned back against the stop *M* to locate it for punching the next slot. The two remaining holes are punched in the same way, thus completing the job in four strokes of the press ram. Although the punch momentarily distorts the tubing, it springs back to its original shape, if care is taken in setting the punch so that it just passes through the wall.

In order to improve the cutting action of the punch *D* and prevent the slugs *S* from clogging the die, the end of the punch is now machined to conform with the radius of the inside of the tube. With the punch ground in this way, the slug *S* is curved instead of straight as shown.

Method that Insures Boring Split Bearings on Exact Center Line

By CHARLES C. TOMNEY, Chief Tool Designer
Carrier Engineering Corporation, Newark, N. J.

Split bearings of the type shown in Fig. 1 are used on compressors. The fixture employed on a turret lathe for boring these bearings is shown in

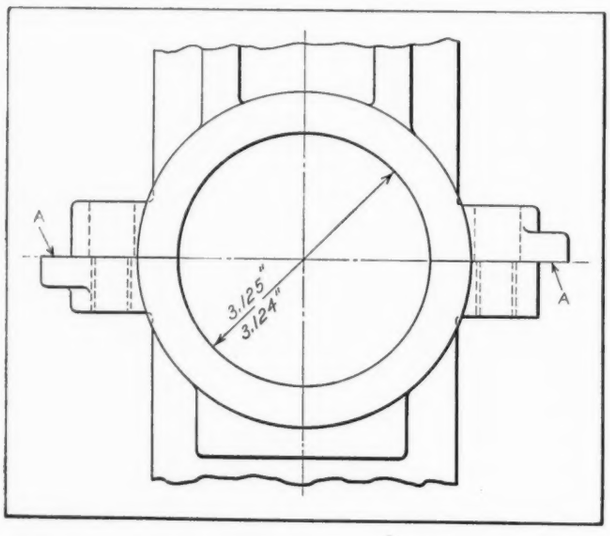


Fig. 1. Lugs A on Bearing Facilitate Accurate Boring

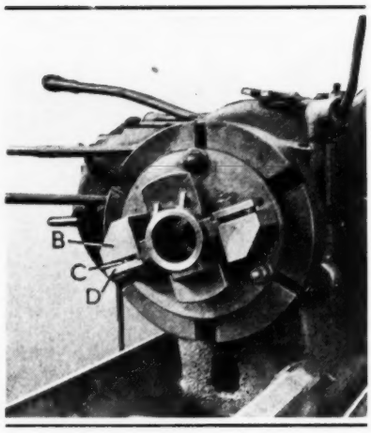


Fig. 2. Fixture with Bearing Shown in Fig. 1 Clamped in Position for Boring

Fig. 2. The interesting feature of the boring operation is the method used to make certain that the bearings are bored on their exact center lines and that each bore is parallel with the face of each half of its respective bearing. This is accomplished by means of lugs *A* on each half of the bearing. The method described should be of general interest, because it can be used in machining split bearings of all kinds.

In this instance, the lugs can be left on after machining, because there is ample clearance in the crankcase. This method is also used for machining parts on which the lugs are removed after machining. The holding fixture, shown in Fig. 2, is made entirely of steel. Blocks *B* have their locating surfaces *C* on the center line. The lugs *A* are clamped against the locating surfaces with clamps *D*.

It will be observed that the lugs *A* are on opposite sides of the upper and lower halves of the bearing. This serves to balance the fixture. The work is located in the fixture by means of stops not shown. The halves of the bearing are first milled and then drilled and tapped so that the assembly can be bolted together before being clamped in the fixture for boring.

Forming Bosses by Welding

By JOHN E. HYLER, Peoria, Ill.

The extent to which cutting and welding torches, as well as welding machines, have entered into fixture building in many plants, has given the designer some new things to think about. The methods available for providing the necessary strength and mechanical features are many. Various kinds of structural steel, as well as plain bar stock, may well be investigated and catalogued by the designer, so that the best design available for any given problem will not be overlooked in planning or working out the details for new fixtures.

The forming of bosses wherever they may be needed on welded frames for jigs, fixtures, or special machines and mechanisms, for example, is accomplished easily and quickly by simply cutting off short pieces of round shafting of suitable size, and welding them securely in place. The height of the various bosses may be closely controlled, so that they will require a minimum of finishing. This procedure is only one example of the many ways in which the construction of jigs and fixtures can be speeded up through the use of new equipment or materials.

Fixture for the Accurate Testing of Eccentric Throw

By FRED B. JACOBS
Cleveland, Ohio

The finishing of eccentric parts by grinding is a simple matter, an offset fixture or an eccentric arbor being the only special equipment required. However, in cases where the eccentric throw, or distance from the high point to the center, must be held within 0.0001 inch, some accurate and convenient means for inspecting or measuring the work must be provided.

In the manufacture of case-hardened eccentric parts for rotor air tools at the plant of the Warner & Swasey Co., Cleveland, Ohio, the special testing fixture here shown is employed for this purpose. The work is slipped over a locating pin and the maximum reading on the dial indicator is noted as the high point on the eccentric passes the contact point of the indicator. The indicator is set from a standard gage. By this simple method of gaging or inspecting the work, the desired dimension from the center to the greatest outer diameter is readily maintained.

Fixture for Checking Dimension from Center of Shaft to Highest Point of Eccentric

Tool for Expanding Piston-Ring

By JOSEPH WAITKUS, Wellsville, N. Y.

In overhauling a number of small-bore oil engines, considerable difficulty was experienced in assembling the piston-rings on the pistons. In this particular case, a special expansion ring was being installed under each piston-ring, thereby complicating the task. All difficulties were overcome, however, by constructing the tool shown in the accompanying illustration.

A narrow strip of No. 21 gage steel *A* was cut or shaped to include four lugs *B* and one lug *C*. Before forming the strip *A* into a circle, the lugs were bent at right angles to their original position. Two handles *D* were then shaped and riveted together at *E* with a small washer between the handles to permit easy movement.

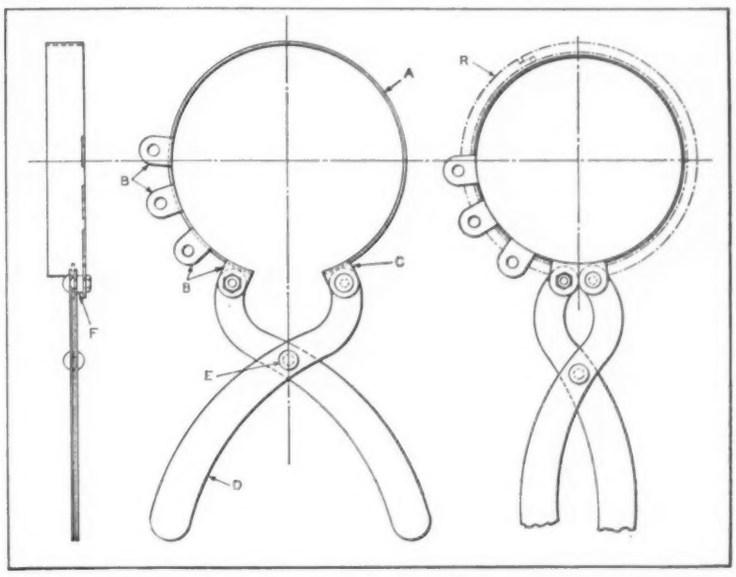
One handle was riveted to the lug *C*, whereas the other handle was provided with a bolt *F* so as to permit connection to any one of the four lugs *B*. The bolt *F* was riveted to the handle and provided with a shoulder to separate the handle from the lug. In order to get the stretching action at the center of the strip *A*, the lug *C* was cut so as to be approximately at the center of the strip.

In operation, the handles are brought together, as shown in the view to the right. The piston-ring *R* and its expansion ring are placed outside of the strip *A*, as indicated. The handles are then pulled apart to expand the piston-ring. Strip *A* is thus opened wide enough to permit it to pass over the piston. The handles are released when the piston-ring is close to the piston groove. It is a simple matter then to slide the piston-ring off the tool into the groove provided for it. The tool is very easy to make and will save a great deal of time and effort. With the extra lugs *B*, various sizes of piston-rings can be accommodated.

Die for Blanking Two Pieces at Each Stroke

By WILLIAM C. BETZ, Equipment Engineer
Fafnir Bearing Co., New Britain, Conn.

Stakes or sheet-metal pieces such as shown at *S*, Fig. 1, for use in assembling locks, clocks, bearing retainers, and hundreds of other products, can be made economically and accurately in the die shown in Figs. 1 and 2. Flat wire stock with round edges is used for these pieces. Two pieces are produced at each stroke of the press, the production from a high-speed press being 18,000 blanks an hour. The



Tool Used in Assembling Rings on Pistons

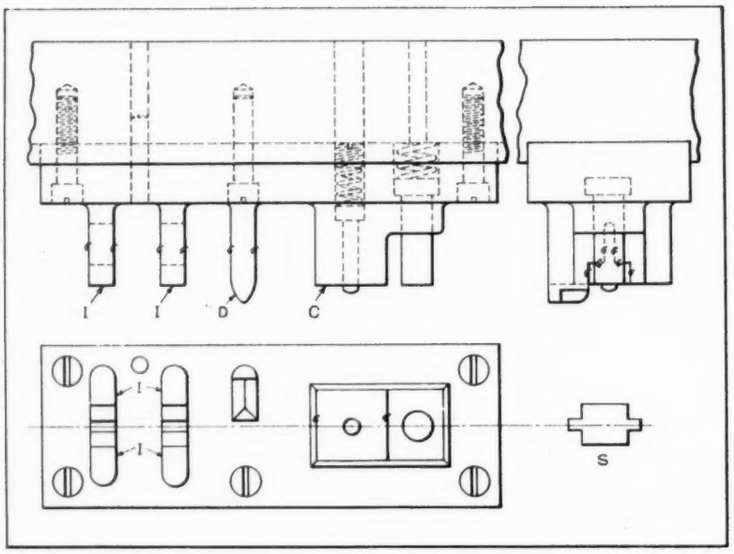


Fig. 1. Plan and Elevation Views of Punch for Blanking Two Pieces S at Each Stroke

stock is first fed to the finger-stop *A*, Fig. 2, after which the roll feed is engaged. The roll feed is set for a stroke equal to the length of two blanks. The punch *D*, Fig. 1, locates the strip in the slot nearest the point of severance of the blanks.

This die is laid out to notch ribbon or wire stock on both sides, so as to produce stakes with shoulders that are parallel to each other and very accurate as to length. The severing punch *C* cuts the blanks off to exact length, cutting between two blanks and pushing one blank down into the die. This blank is returned to the level of the die surface through the action of the shedder *F*.

A small spring-operated plunger is built into the punch *C* for the purpose of kicking off the severed blank, so that it cannot be carried up with the punch and cause trouble. A spring-operated hold-down punch (shown at the right of punch *C*) holds the end blank while it is being severed. The finished blanks are pushed off the die as the stock is fed through. The blanks have exceptionally clean edges, the punches leaving practically no round corners. With this type of die, the stripper must be kept close to the top of the strip stock, because if much space is left between the top of the strip and the stripper, the punches will have a tendency to cramp the shoulders of the blanks and turn the edges down.

In making the die, the work is laid out very carefully with accurate size blocks or a height gage. Five holes, accurately spaced, are bored and reamed to locate and pilot the four notching punches *I* and the pilot punch *D*. The punch-block group is accurately milled, an allowance being made for grinding.

After being hardened, the punches are ground all over, so that the center spacing is very accurate and so that the slots punched in the stock will be accurate as to width. The finished punch assembly is fastened to the punch plate of a pillar type die set. The die, after being roughed out, is fastened in a shoe of the die set, so that the punches can be used to locate and shear the punch slots in the die.

The pilot punch *D* is left square on the end until the die has been laid out and sheared, after which the end is ground to the wedge shape shown.

* * *

Increasing Importance of Flame Cutting

Experience with oxy-acetylene shape-cutting has given the metal-working industries entirely new conceptions of speed, economy, and efficiency in cutting steel and iron. The recognition being given to the use of steel plates, rolled sections, and slabs as raw material which may be cut and shaped to form the parts for fabrication into almost any required shape is direct evidence of the economic importance of this development.

There have recently been made available several new types of cutting machines which greatly extend the field of application for machine cutting. Some of these are portable so that, where necessary, they can be brought to work which would otherwise be difficult if not impossible to convey to a stationary machine.

Investigations indicate that the present stage of development does not even begin to touch the ultimate possibilities of flame cutting. Some work has already been done on flame machining, but the many ramifications of this subject still remain to be explored.—*Oxy-Acetylene Tips*

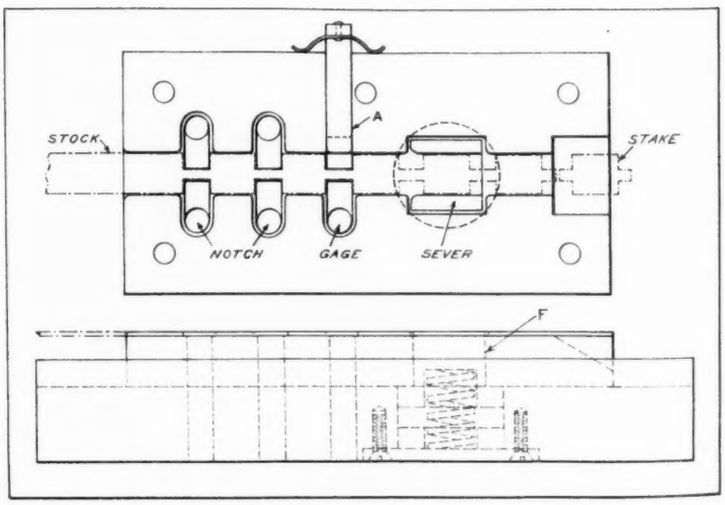


Fig. 2. Plan and Elevation Views of Die Member Used with Punch Shown in Fig. 1

Lubrication Problems Require Thorough Study

A Review of the Factors that Must be Given Consideration, and Some Examples of Everyday Applications

By A. F. BREWER
Mechanical Engineer, The Texas Co.
New York City

IN the development of the theory of lubrication, research has been particularly directed toward a study of the formation and maintenance of a lubricating film within the clearance space of the plain or sleeve type bearing. Here the relative ability of any type of lubrication to form a protective film can be effectively measured and data gathered with respect to pressure, speed, temperature, and bearing design.

All of this is of considerable interest to the research student, but too involved, perhaps, for many engineers engaged in actual practice, who must daily meet the prevailing conditions of operation in their plants, solve their lubricating problems, and keep machinery running. It is a question whether it is not more important for the operating engineer to study lubrication from a practical rather than a theoretical angle, with the objective of determining the mechanical causes of lubrication difficulties. By a thorough understanding of the principles of design, methods of lubrication, and the properties of lubricants, concrete benefits can accrue which will often eliminate the cause of trouble; whereas, even where theory seems to have been correctly applied in design, one often meets with impaired lubrication under abnormal operating conditions.

In order to emphasize this point, typical conditions of operation are discussed in this article, and attention is called to the advantage to be derived from better cooperation between the machinery builder, the operator, and the lubricating engineer.

Careful Experimentation Has Developed Lubricants for Specific Purposes

The extension of the application of ball and roller bearings to higher speed and load conditions, where continuous operation for months at a time without relubrication may be essential has entailed renewed study of the distinctive characteristics of oils and greases to meet the intensive requirements of such service. Evidence of the interest of the bearing manufacturers is indicated by the development of extensive laboratory testing equipment and methods for analyzing bearing performance under simulated operating conditions.

By running any such bearing under controlled temperature and speed conditions for a long period of time, one may predict what can be expected from any grade of lubricant and its relative resistance to oxidation and separation or breakdown under higher temperatures. This leads to more intelligent recognition of the characteristics that a lubricant should possess to meet such conditions, and facilitates the choice of suitable products for the initial packing of the bearings and the subsequent relubrication.

The cooperation of the petroleum industry in this progressive movement has been noteworthy to the extent that in the design of steel mill bearings the results of using grease-lubricated roller bearings have been so pronouncedly better as to lead some authorities to predict a complete transition to such bearing design within the next few years.

The Importance of Lubrication Requirements is often Overlooked by Designers

Frequently, however, the intimate tie-up between lubrication, lubricating equipment, machine design, and ultimate production is not fully understood by the designing engineer. Many do not appreciate the importance of a knowledge of operating conditions with respect to the means of lubrication. One would not install a sight-feed oil-cup on a high-powered turbine bearing, nor a hand-compression grease cup on an inaccessible overhead lineshaft bearing. The one would not afford sufficient lubrication, unless under continuous observation; the other, being out of reach, would probably get no lubrication at all. The designer should, therefore, know the limitations of sight-feed oilers, as compared with pressure circulating systems, just as he should realize that accessibility plays an important part in the maintenance of lubrication. Grease lubrication and its adaptability to ball or roller bearings in inaccessible locations should also be carefully studied in making original designs.

No industry is an exception. Each one involves points where lubrication problems may develop if careful thought is not given to the choice of the most suitable means of lubrication for applying a lubricant best adapted to the operating conditions.

In the paper industry, for example, the possibility of water or pulp contamination of grease-lubricated paper-machine bearings must be considered quite as seriously as the effects of temperature on the bearings of a calender stack. In the one case, a non-soluble grease is frequently used, applied by

means of lubrication that will prevent water from entering, as far as possible. Sealed ball and roller bearings are in high favor on paper-machine wet end rolls. Here the best means of lubrication is the grease gun, using individual pressure fittings on each bearing.

The calender roll bearings, however, require oil lubrication. The oil used must be of sufficient body to resist the viscosity reducing effects of high temperatures, due to the fact that steam is used for final finishing of the paper as it passes over the rolls. In consequence, flood lubrication is advantageous, for the oil serves not only as a lubricant for the roll bearings, but also as a coolant, carrying a certain amount of heat back to the filter and storage tank, where it is dissipated prior to recirculation. The designer must select an oil-pump of suitable capacity, as well as piping of adequate diameter. Should a pump that is too small be installed, in the interest of economy of construction, it might fail to deliver a sufficient volume of the comparatively heavy-bodied oil to cool the bearing to the proper degree.

The Lubrication of Electric Motors for Different Services

Electric motor bearings offer another field of study for the designing engineer. Sleeve type or anti-friction bearings are readily adaptable to almost any motor. Subsequent lubrication, however, is an important factor. A motor installation on an airplane beacon requires positive operation for long periods of time without relubrication; hence the efforts of ball-bearing manufacturers to produce bearings so completely sealed as to enable them to retain their original charge of grease for many months. In appreciation of this requirement, the petroleum industry has made a study of grease manufacture, in order to develop lubricants that will maintain lubrication for a long period without change in structure, homogeneity, lubricating ability, or leakage.

On the other hand, to attempt to use completely sealed bearings in the cement mill, for example, might lead to serious bearing failure. Here the grease must serve to prevent entry of abrasive foreign matter, just as it does on a shackle bolt. A bearing that permits some leakage, so that a collar of grease develops and frequent relubrication is necessary, is often the safest installation in such service, especially in view of the variety of load and temperature conditions involved.

Motor bearings of household appliances, in turn, are frequently oil-lubricated by means of a wick or felt packing located in the base. Such devices are very effective on washing machines, provided the oil-cups are located so that the housewife can reach them conveniently with an oil-can. In many cases, however, the designers have apparently overlooked this necessity, placing the cups so that virtually two people are required to do the oiling, and with no assurance that the oil is entering the cup. This is one reason why the ball-bearing and motor manufacturers have recently studied the field of household machinery so extensively. The ideal would be a ball bearing, grease-lubricated, and so effectively sealed that months or even years might pass without the necessity for relubrication. The refrigerating machinery designers have accomplished this, and indications are that vacuum cleaning devices will ultimately be built in a similar manner.

Lubrication Requirements Should be Specified by the Manufacturer

Assume that the machinery builder has realized that effective lubrication begins with the design of a machine—not after it has been put in operation—and that the wearing elements have been designed to function on the most suitable grades of lubricants to meet the expected operating conditions. Then these lubricants should be clearly specified to the user, according to their salient characteristics.

As an example, a recommendation for worm reduction-gear lubrication should consider the probable operating temperatures, the speed, the location of the worm with respect to the gear, and the operating load. Under normal conditions, a heavy lubricant like a steam-cylinder oil, carrying a certain amount of compound to improve the lubricating film on the gear teeth, would be required. Should such a gear set be installed in a cold room, however, with operating temperatures in the neighborhood of zero, the viscosity of the lubricant would have to be such as to permit ready starting and reduce the running torque. Research has indicated that light oil of around 100 to 200 seconds Saybolt universal viscosity at 100 degrees F., will best meet these conditions.

In the power plant, a recommendation for steam-cylinder lubrication, where saturated steam is involved, might specify a highly refined grade of steam-cylinder oil having a viscosity range of 120 to 140 seconds Saybolt universal at 210 degrees F., and containing from 4 to 6 per cent of high-grade animal oil compound. The latter should vary according to the moisture content of the steam, the viscosity depending on the steam pressure.

Under normal conditions, the user could call on any reputable lubricating oil refiner in his vicinity to meet the above specifications, with the assurance that the requirements would be met. Many machinery builders, however, consider it advisable to make specific recommendations by brand name, after determining upon the products of a number of representative manufacturers of lubricants that will most satisfactorily meet the operating conditions and that are available over a wide area. Frequently these lubricants are subjected to more or less extensive tests, according to the intricacy of the parts to be lubricated. Once assured of their suitability, operating instructions can be prepared, including lubricating specifications and advice as to usage.

Advantages Gained by the Machine Builder in Specifying Lubrication Requirements

It is of distinct advantage to study the problem of lubrication in this manner, together with the proper grades of oil or grease to use on the wearing parts of any machine, for it is insurance against future claims of unscrupulous users in the event of careless handling or neglect. It will often deter a careless operator from presenting unfair claims in the event of burned out bearings or excessive wear. In other words, when the machinery builder has furnished instructions as to care, operation, and lubrication, with specifications of the most suitable lubricants, including advice as to frequency of application, such claims can often be prevented, especially where a careless, negligent attitude prevails among the operators or where there is proof that cheap, unsuitable, or improperly refined lubricants have been used.

An added point in favor of formal notification of lubrication requirements is that machinery is often turned over after erection or installation to operators who are relatively inexperienced in its design, construction, and lubrication. It is too risky to assume that all will be familiar with the lubrication requirements of the various moving parts involved or that the cooperation of a capable lubrication expert will be enlisted. Too many operators have a personal preference for certain types of lubricants and let this preference influence their judgment. Operating efficiency may suffer accordingly, and ultimately the cost of repairs may indicate the unsuitability of the lubricants used.

An Oil Suitable for One Application May Not be of Value for Another

There is very good reason for the extensive variation in viscosity of oils or consistency of greases on the market today. Those who are familiar with machine operation realize the degree to which operating conditions differ. Bearing pressures, speeds, temperatures, clearances, areas of contact, gear tooth pressure, or the necessity of operating in the presence of dust, dirt, water, or other contaminating foreign matter, all impose requirements that must be taken into consideration. Each presents its own individual problem, which requires very careful study with relation to the others. It is, therefore, erroneous to assume that any grade of oil or grease that has proved satisfactory on certain types of equipment will serve equally well on any other, especially where the operating conditions are different. Many who are in charge of operations, however, limit their personnel to the use of but one or two lubricants, overlooking the extent to which these may be suited to the operating requirements of all the equipment involved. Here, of course, the services of the experienced lubricating engineer become valuable.

Of course, in many plants perhaps a single grade of steam-cylinder oil, a medium-viscosity machine oil, and a medium- or light-consistency cup grease may suffice. Normally, however, in the modern industrial plant, the equipment involved is so designed as to include a considerable number of wearing elements of widely differing construction. Just as this construction differs, so may it be expected that the lubricating requirements will differ. In many cases, similar lubricants can be used; on the other hand, every case should receive individual attention in deciding upon the lubricants that will promote most efficient operation. In this way, production can be most surely maintained at minimum cost.

The Value of Lubrication Charts—They Emphasize Importance of Lubrication

In connection with machinery installations, specifications as to lubrication, and in many cases lubrication charts, have been found to be of much value. Many builders either prepare these in the form of metallic plates attached rigidly to the machinery or furnish instruction cards for posting in a conspicuous place. Both serve the same purpose, as they draw the operator's attention to the fact that there are certain wearing parts of the machinery that require lubrication with products of certain definite characteristics—not merely whatever he likes best or whatever he has at hand. In this way, he is also relieved of a certain amount of responsibility, his only care being proper maintenance of lubrication.

Charts of this nature have been readily adapted to many types of industrial machinery, such as newspaper presses, tractors, electric trucks, certain textile machines, and machine tools, in quite as successful a manner as they have to the automotive industry. The psychological effect that a lubrication chart will have is believed to accomplish far more than many pages of written instructions, for certain important, though perhaps obscure, parts will be noticed which might easily be overlooked on casual inspection of the machine or on first reading of a detailed set of lubrication instructions.

On the other hand, lubrication instructions serve an excellent purpose by arousing an interest as to the reasons for lubrication, especially where pains are taken to tell the operator something of the details of construction of the parts involved; the extent to which ball, roller, or plain bearings are employed, and the reason why; the capacity of oil reservoirs; the approximate speed of rotation; and the basic characteristics of such lubricants as have been found most suitable. This can be done with entire fairness to the builder and the lubricant manufacturer. The user can thus be particularly impressed with the importance of the entire matter of lubrication and the extent to which he will profit, in terms of increased production, by appreciation of this fact, for his operating and maintenance costs should be directly affected. Today that is a most vital problem.

Surface Hardening for Bearing Purposes

An Investigation into the Use of Hardened Steel Surfaces in Bearings, and Suggestions for Their Successful Application

By CHRISTOPHER H. BIERBAUM, Vice-President
Lumen Bearing Co., Buffalo, N. Y.

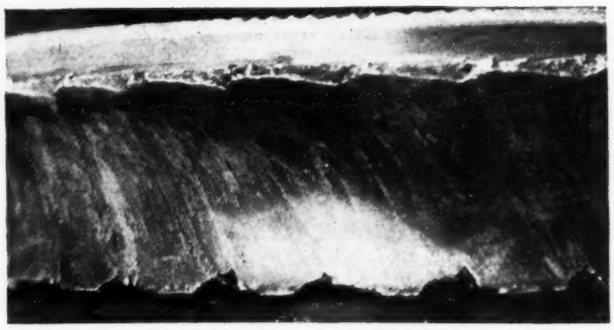


Fig. 1. Bronze Worm-wheel with Teeth Completely Milled off by Cracks in Case of Engaging Worm

THE practice of hardening the steel surface of one member of a bearing to mate with a corresponding surface of hard or chilled bronze is well established. This procedure, when properly carried out, can give very satisfactory results. Case- or pack-hardening, cyaniding, and nitriding are the three methods commonly used for hardening such surfaces.

In every instance, the part of the material so hardened expands permanently during the hardening process, with the result that, under an even temperature of case and core, the case is always in a state of compression and the surface immediately beneath the case is in tension. Now, all case materials have a higher thermal coefficient of expansion than the core, and under service conditions, the case is always at a higher temperature than the core; the combined effect, therefore, frequently is to cause the case to buckle and crack. The best results are always obtained when the hardness of the case gradually blends into that of the softer core, even though the maximum hardness of the case is not obtained. The more sudden the transition from the hardness of the case to that of the core, and the thinner the case, the greater is the tendency for the case to buckle and crack. These facts, in so far as they relate to bearing requirements, seem to have been overlooked entirely in our modern progress of steel treating, in which the apparent aim has been economy only—that of producing a file-hard surface at the least possible cost.

All casehardened bearing surfaces that crack or check under service conditions should be condemned without further consideration. This condemnation should be general; it should apply to

Fig. 2. Photomicrograph of a Case Particle Embedded in a Bronze Worm-wheel—Magnified 100 Times

Fig. 3. Cracked Worm Case, Abraded by Case Particles Embedded in Worm-wheel—Magnified 100 Times

any and all material where microscopic checks are developed, since such minute checks, though they may be invisible to the naked eye, act as effective milling cutters. Fig. 1 furnishes such an illustration—a bronze worm-wheel with the teeth completely milled off by the sharp edges of the minute checks in the case of the engaging worm. Figs. 2 and 3 represent an even more severe condition; namely, a worm-gear in which the worm case checked and chipped off. Fig. 2 shows a particle of the chipped off worm case embedded in the tooth of the bronze gear. Fig. 3 shows the checked case on the worm and the abrading effect produced by such embedded particles of the case. The criticisms relative to the checking of cases apply equally to all hardened spindles or journals.

The finishing of surfaces for casehardening is often not given the attention it deserves; these surfaces should be clean and smoothly ground, because an uneven surface must of necessity produce an uneven depth of case. In the preparation of the surfaces, the grinding should be done with a clean wheel; a gummed or "loaded" wheel should never be used. There should be no distortion or disturbance of the grain on the surface to be hardened. Whenever warping occurs during hardening, and the necessary subsequent grinding for truing the surfaces is sufficient to cut through the case, even in minute spots, nothing but unsatisfactory results can be expected.

An extended study of pack-hardened bearing materials seems to indicate that the practice of casehardening for bearing purposes twenty or more years ago was superior to the most up-to-date practice, especially so in relation to pack-hardening as compared with cyaniding. In the earlier practice of casehardening, the transition from the hard surface into the core was a more gradual one, and as a rule, the case was not so brittle and glass hard, therefore lending itself better to bearing requirements. The application of the worm-gear as a mechanical unit, with a possible efficiency of 97 per cent, has suffered enormously in recent years, due to improper steel treating. Heat-treated alloyed steels and tempered tool steels, although higher in first cost, are a distinct economy over all improperly surface hardened material for bearing service, owing to their relatively high degree of homogeneity.

Among the methods of hardening bearing surfaces, chrome-plating may be mentioned, since in some instances it has been productive of very superior results. The underlying requirements for the successful application of chrome plate for bearing services are relatively simple. The chrome plate as a rule is an exceedingly thin layer and hard; therefore, the surface to be plated should be highly accurate and polished before plating, as after it is put in service no additional polishing of any consequence can occur. The supporting material must be hard enough to support the load without distortion, in order to prevent the cracking of the plate. This supporting material should be homogeneous, since experience shows that the chrome-plating of bronze bearing surfaces has invariably proved a failure.

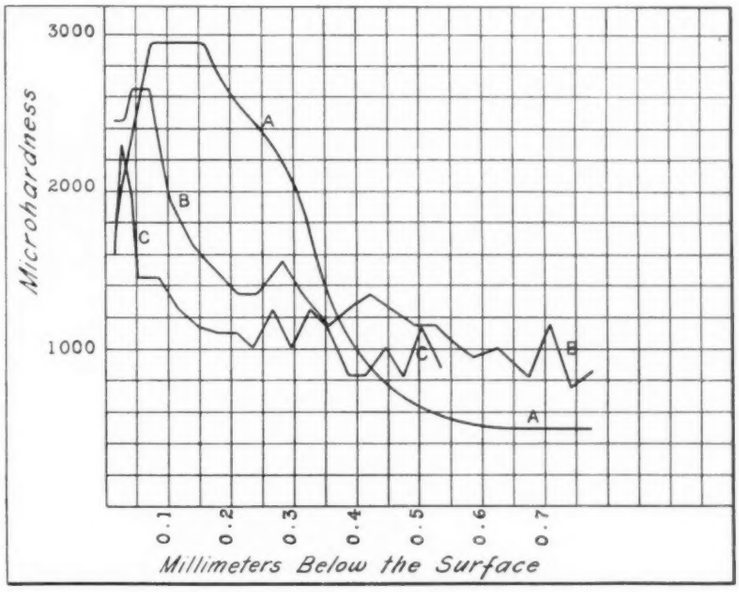


Fig. 4. Diagram Showing Characteristics of Casehardened Surfaces — (A) Nitrided Nitralloy Case; (B) Pack-hardened Case; (C) Pack-hardened Case

The nitriding of Nitralloy is a more modern method of producing a hard case; for bearing purposes it seems to offer special advantages, but evidently it has not yet been given the recognition in this field that it deserves.

Microcharacter studies of these hardened bearing cases are of special interest. ["The Microcharacter," Trans. A.S.S.T. January, 1931] Fig. 4 gives the results of such studies plotted on coordinate axes, the vertical ones giving the microhardness, and the horizontal ones the depth beneath the hardened surface in terms of tenths of a millimeter. Curve *A* shows the characteristics of a nitrided Nitralloy surface, and curves *B* and *C* those of two pack-hardened surfaces; *B* represents an ordinary pack-hardened case, and *C* the worst of "efficiency methods" in modern heat-treating. In general, for the best bearing service conditions, it

is essential that one member have the highest possible degree of microscopic homogeneity, and the other the heterogeneity of a bearing metal ["A Study of Bearing Metals," Trans. A.I.M.E., 1923]. A casual inspection of curve *A* shows that the nitrided surface is hard and highly homogeneous; whereas curves *B* and *C* indicate that the pack-hardened surfaces are made up of comparatively hard and soft crystals.

The nitrided Nitralloy steel represented by curve *A* was nitrided for forty-eight hours at 950 degrees F. with 25 per cent dissociation. The composition of the steel is as follows: Carbon, 0.316 per cent; manganese, 0.63 per cent; sulphur, 0.02 per cent; phosphorus, 0.018 per cent; silicon, 0.16 per cent; chromium, 1.12 per cent; molybdenum, 0.19 per cent; and aluminum, 0.93 per cent.

The steel represented by curve *B* is an S A E 4615 steel, carburized four hours at 1650 degrees F., oil-quenched from pot, reheated to 1450 degrees F., oil-quenched, and tempered at 300 degrees F.

The S A E 6115 steel represented by curve *C* was carburized four hours at 1650 degrees F., water-quenched from pot, reheated to 1450 degrees F., water-quenched, and tempered at 300 degrees F.

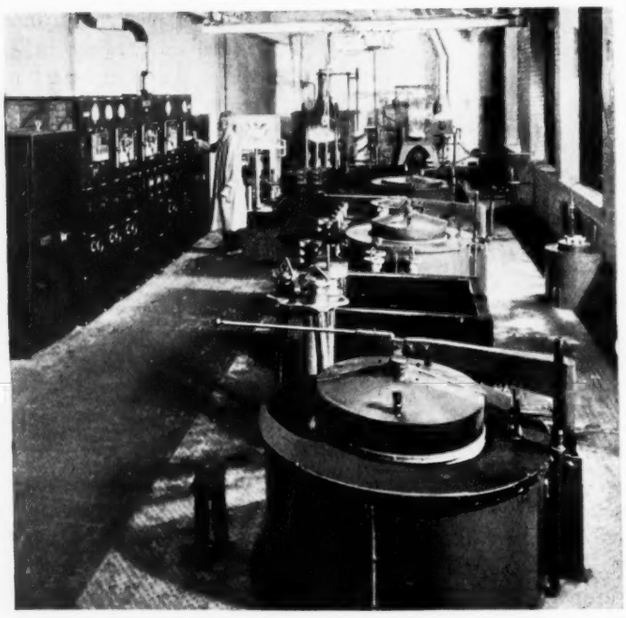
As a purely theoretical consideration, the facts shown by curve *A* are highly interesting, but what is of still greater interest is that, in the results obtained by the proper application of this material in actual bearing service, the theoretically anticipated results were fully realized. As an illustration: A helical gear on the engine of a Greyhound bus, driving the oil-pump and one timing unit, at full speed has a velocity of sliding surfaces of 1 1/10 miles per minute; one member is a nitrided Nitralloy and the other a hard copper-tin bronze. In the first test, no special finishing of the surfaces was done. The nitrided surface, as taken from the furnace, wore directly upon the bronze, with the result that after a two-hour run of the engine on the block, the bronze was badly worn—in fact, the teeth were nearly gone. The first impression, therefore, was to condemn nitrided Nitralloy for worm-gear service.

A microscopical examination of the nitrided surface revealed the secret that polishing or burnishing was necessary. This, in turn, was accomplished by cutting a gear wheel of hard wood, uniform in size with the bronze member, and then running the nitrided gear against this wooden wheel, with oil and fine emery dust, until a mirror-like surface was obtained. This nitrided member was then put back into service mating with a bronze gear, made of the same heat of metal as the first, with the phenomenal result of having only 0.0002 inch wear on the pitch line of the bronze teeth after the engine had run 40,000 miles.

It is self-evident that the conditions governing the "running in" of ordinary bearings, where the two members mutually polish each other, cannot obtain when one of the members is hardened steel. The hardened steel surface should, therefore, be finished before being put in service, so that no additional truing nor polishing is necessary. With the introduction of nitrided Nitralloy as a bearing member, the importance of starting with extremely accurate and highly finished surfaces cannot be overestimated.

* * *

The General Electric Co. announces that the orders received for the first nine months of 1935 amounted to about $159,000,000, compared with $132,600,000 for the same period in 1934. The Westinghouse Electric & Mfg. Co. reports orders for the first nine months amounting to $95,500,000, against $79,000,000 for the same period last year.



The machine tool industry uses the latest types of heat-treating equipment. This illustration shows the heat-treating department of the Monarch Machine Tool Co., Sidney, Ohio, which was recently modernized by the installation of a pair of triple-control Hump Vapocarb electric hardening and carburizing furnaces, a Homo electric air tempering furnace and an Oakite electrically heated wash tank. In addition to the electric equipment, there is a small gas forge, two box type auxiliary gas-fired furnaces, an oil quenching tank, and a water cooling tank.

Gear Manufacturers' Semi-Annual Meeting

THE eighteenth semi-annual meeting of the American Gear Manufacturers' Association was held at the General Brock Hotel, Niagara Falls, October 14 and 15. As usual, the sessions were mainly occupied by the work of the standardization committees.

In his opening address, the president of the Association, A. A. Ross, of the General Electric Co., stressed the importance of the work of the Association, not only to its members, but to the gear industry as a whole. W. J. Donald, managing director of the National Electrical Manufacturers' Association, spoke on "Trade Association Objectives, Policies, and Activities under Present Conditions." He emphasized that bigness in business has merit only as it represents efficiency. If, because of its size, a business can produce at less cost and give more service, then size is of value. He warned against trying to obtain a large volume of business at the expense of profits, pointing out the folly of spending the profits on 90 per cent of the business in obtaining the last 10 per cent, something that is quite frequently done.

Several addresses pertaining specifically to the design and manufacture of gearing were read. John T. Howat of the Pittsburgh Steel Foundry Corporation, Glassport, Pa., read an address entitled "Metallurgical Analysis of Gear Failures as Seen through the Microscope." P. C. Day, chief engineer, and W. P. Schmitter, research engineer, of the Falk Corporation, Milwaukee, Wis., presented a paper entitled "Speed Increasing Gears and Their Technical Differences from Reducing Gears." J. O. Almen, of the research division of the General Motors Corporation, Detroit, Mich., read a paper on "Factors Influencing the Durability of Automobile Spiral Bevel Gears." James L. Draper, chief lubrication engineer of the Texas Co., Boston, Mass., dealt with "Lubrication of Enclosed Gear Drives."

The management side of the industry was given attention in the papers "Analysis of Our Cost Accounting Manual," by H. N. Mathias of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and "Educating Employes," by H. H. Kerr, president, Boston Gear Works, North Quincy, Mass.

We are All Helping to Pay*

THE Social Security Act, the Four Billion Dollar Relief Act, and other measures passed by the last Congress, provide for the expenditure of vast sums. The expenditures of the federal government are most talked about, but the amount to be spent includes also state and local expenditures. The total is a staggering figure. All this has to be paid for. Everyone who has any kind of property or who has a job from which he gets an income helps to pay. It is not only those having much who pay, but also those having little.

Everyone who earns anything pays a tax, because taxes are either collected from, or passed on to, all who have an income and have something to spend. Income taxes may seem to bear only on those having fairly large incomes, and those who do not pay directly may think that they escape; but the effect goes further than the person paying the tax; and every tax paid by a business concern comes from money that otherwise would have been available to benefit someone in lower prices, higher wages, dividends, or plant expansion.

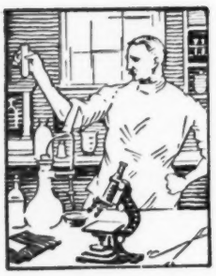
Income taxes are not the only ones affecting many. Money for state and local expenditures usually is raised by direct tax levies on property. A property tax paid by a business concern can come from one source of income only—the customer who pays the tax by paying a higher price, exactly as if he were paying a sales tax. These indirect tax payments, even though they are hidden, mount high, and are a heavy drain on everyone, no matter how small his income is. A recent striking example of hidden indirect taxation is the processing tax on meat, grains, and cotton. The Government is paid by the processor, but the tax is actually paid by the consumer. Now we get only two pork chops for the price that formerly bought three; the Government takes the third chop.

Normally, there are 50,000,000 people gainfully employed in the United States in industry and agriculture. Assuming that there are 10,000,000 unemployed, there still are 40,000,000 people employed. Every one of these helps to carry the tax load. On an average, every one will pay $100 for the $4,000,000,000 relief bill alone.

What has been done must be paid for. But the 40,000,000 who pay the government bills have the power to decide for themselves how much of their income they are willing that the government shall take. Every one of the 40,000,000 who pay ought to tell their congressmen, state legislators, and local officials how much of their wages and income they want these men to spend—whether they want government expenditures increased or decreased.

*Abstract of an article by George P. Torrence, President of the Link-Belt Co., Published in the *Link-Belt News*.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

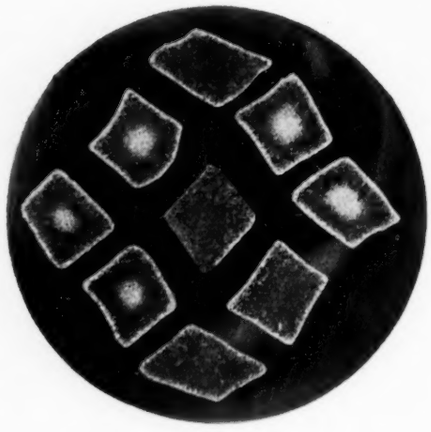
Light-Weight Car Frame Shown at the Metal Exposition

Among the interesting exhibits at the National Metal Congress and Exposition was a truck side frame for a 40-ton freight car. This frame was cast by the Gould Coupler Co., Depew, N. Y., from high-strength nickel manganese steel. By using this material, the weight was reduced to 468 pounds, as compared with 546 pounds for a carbon steel frame made according to A A R Specification Grade B. A weight saving of 15 per cent was realized.

This casting was included in the exhibit of the International Nickel Co., Inc.

Stainless Steel Bars with Inserts of Low-Carbon Steel

A composite stainless steel stock known as Silverbond has recently been developed by the Jessop Steel Co., Washington, Pa., for many applications where the outside surfaces of bars or sheets must possess the corrosion- and temperature-resisting properties of stainless steel. This new product is described as having a web-like structure of stainless steel, in which inexpensive inserts of low-carbon steel are used to the extent of approximately 40 per cent. These inserts are held mechanically, as well as being welded by the application of pressure at high temperatures, and so there is no possibility of the inserts becoming loose. The illustration shows an enlarged cross-section through a typical bar.



Cross-section through a Stainless Steel Bar Containing Inserts of Low-carbon Steel

This composite stainless steel stock is produced in round, flat, octagonal, and hexagonal bars; sheets; strips; and other shapes to meet requirements. It is being used in the manufacture of refrigerator trays and accessories, shafting that does not require machining, and architectural and general decorative trimming.

High Tensile Strength a Feature of a New Copper Alloy

Unusual strength and high electrical conductivity are the principal characteristics of Mallory 3 metal, a new copper alloy recently announced by P. R. Mallory & Co., Inc., Indianapolis, Ind. Rods of this metal have an elastic limit of 50,000 pounds per square inch and an ultimate strength of 70,000 pounds per square inch, while castings have an elastic limit of 25,000 pounds per square inch and an ultimate strength of 50,000 pounds per square inch. Castings have a high impact strength which is retained at elevated temperatures; at temperatures up to about 775 degrees F. the impact strength does not fall below 50 foot-pounds.

Forgings and drawn rods have an electrical conductivity 80 to 85

per cent that of copper, while sand castings have an electrical conductivity between 75 and 85 per cent that of forged copper. Bars and rods have a hardness of 150 Brinell or greater, while sand castings have a hardness of 116 to 125 Brinell.

Mallory 3 metal is being used extensively for spot-welding tips, flash-welding dies, and seam-welding wheels, and in numerous other applications where a high-strength metal of high electrical conductivity is required. It can be supplied in the form of rods; bars; dies; drop-forgings; regular forgings; cold-drawn, swaged, cold-headed, or extruded parts; and sand castings.

Thin-Wall Stainless Steel Tubing Now Made by Allegheny

Thin-wall stainless steel tubing that costs approximately one-quarter the price of seamless stainless steel tubes of corresponding size is being placed on the market by the Allegheny Steel Co., Brackenridge, Pa. This tubing is intended for a large variety of applications, such as hand-rails, foot-rails, and metal furniture. When greater strength and rigidity are required than are provided by the plain tubing, carbon steel inserts are fabricated into the tubing.

Round tubing is available in outside diameters of from 5/8 inch to 1.9 inches. Square and rectangular shapes will also be produced.

Alloy of Platinum and Rhodium Resists Hot Flowing Glass

In the production of bulbs for electric lamps, the Westinghouse Lamp Co. formerly used porcelain dies which eroded in a few hours. This made it difficult to maintain a uniform stream of the molten glass and a new die usually had to be installed after fifteen hours.

After numerous tests with high-temperature metal alloys and various refractory compositions (none of which proved better than porcelain), Henry K. Richardson and Frank A. Newcombe discovered an alloy that increased the life of these dies 190 times. For this achievement, they received the company's 1934 award for outstanding accomplishment.

This new alloy consists of 90 per cent platinum and 10 per cent rhodium. A lining made of the alloy, 0.030 inch thick, is inserted in an Alundum refractory support to form the die that is now in general use.

A New Alloy for the Production of Brass Die-Castings

The Doehler Die Casting Co., 386 Fourth Ave., New York City, is introducing a new brass die-casting alloy on the market under the trade name of Doler-Brass. This new alloy contains copper, zinc and silicon. It is said to produce die-castings with an unusually fine finish.

The important physical properties of the alloy are as follows: Tensile strength, from 65,000 to 75,000 pounds per square inch; yield point, from 30,000 to 40,000 pounds per square inch; elongation, from 20 to 25 per cent in 2 inches; Brinell hardness, from 110 to 120; and impact strength, 30 to 36 foot-pounds. The alloy is light yellow.

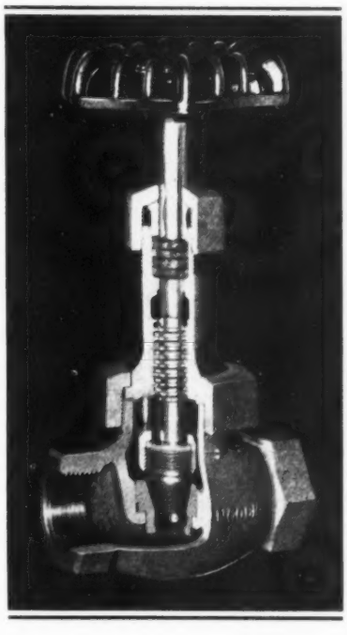
A New Molding Material that is Non-Bleeding

Molded plastic parts exposed to acetone and other strong solvents or acids sometimes are subject to bleeding of the dye. To overcome this problem, General Plastics, Inc., North Tonawanda, N. Y., have recently brought out a non-bleeding Durez material known as 3973 Black. This new plastic material has a high gloss finish, high torsional strength, and a compressive strength of 30,000 pounds per square inch.

Stainless Steel Now Used in Bronze Valves

Disks and seats made of stainless steel and hardened to 500 Brinell have been adopted for a bonnet type valve which is now being introduced on the market by the Hancock Valve Division of the Consolidated Ashcroft Hancock Co., Bridgeport, Conn. By using stainless steel for these parts, wire-drawing, steam-cutting, galling, etc., are said to be prevented.

The valves are made in both globe and angle types for pressures up to 300 pounds per square inch, the globe type being shown in the accompanying illustration. Special bronzes were developed for the stem and bonnet to give long service life. The disk is attached to the stem in a manner that insures correct seating and facilitates regrinding.



Bronze Globe Valve Fitted with Disk and Seat Made of Stainless Steel

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Carboloy Tools

CARBOLOY CO., INC., 2987 E. Jefferson Ave., Detroit, Mich. Booklet A-11, illustrating and describing fifty-five applications at the recent Machine Tool Show in which Carboloy cemented-carbide tools were used. The examples shown cover a representative cross-section of machines, operations, and materials. The data includes practically every type of machine in common use. The materials cut include cast iron, steel, brass, bronze, and aluminum alloys, and all of the common machining operations are represented. In each case speeds, feeds, depth of cut, floor-to-floor time, etc., are given.

Wire Cloth

AUDUBON WIRE CLOTH CORPORATION, Richmond St. and Castor Ave., Philadelphia, Pa. 56-page catalogue 40-32, covering the complete line of wire cloth made by this concern. The catalogue contains illustrations, descriptions, specifications, and list prices of the various products, together with tables and useful information for selecting and specifying wire cloth. This concern is also issuing a 16-page catalogue 41-32, featuring flexible wire cloth. In addition, there is an 8-page condensed catalogue 42-32, describing the entire line, but not including prices.

Inclinable Power Presses

V & O PRESS CO., Hudson, N. Y. Catalogue 35, covering the line of inclinable open-back power presses made by this concern. The construction features of these presses are described in detail, and replacement charts are included, which show clearly all parts pertaining to the standard machine. Complete specifications are given for the various sizes. A feature of the catalogue that should be of value to designers and engineers is a complete set of drawings covering the different sizes of presses, which give all dimensions necessary for designing dies.

Carbide Tools

FIRTH-STERLING STEEL CO., McKeesport, Pa. Catalogue covering the new sintered carbide compositions known as "Firthite" made by this company. The catalogue lists the standard grades, the forms in which they are supplied, and gives tables of dimensions for the standard tools. A description is included of the designing and making of Firthite tools and the setting and using of these tools. There is also a section on costs. Supplementing this catalogue, a complete price list is issued for Firthite standard tools, bits, and blanks.

Zinc Alloy Die-Castings

NEW JERSEY ZINC CO., 160 Front St., New York City. Booklet entitled "A Visual Report of Progress," containing a collection of photographs showing the widespread use and applicability of zinc alloy die-castings. The examples shown are actual parts produced by commercial die-casters, and are taken from almost every industry in the country. This cross-section, showing how industry as a whole utilizes zinc alloy die-castings, should be of suggestive value to all those connected with the design, manufacture, and sale of metal products.

Bronze Alloys

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. 26-page booklet on Permite 6-foot cast-bronze bars, containing valuable data on the uses and properties of various bronze alloys. Graphs are included showing the behavior of the alloys as the contents of different metals are altered. The booklet also shows the steps necessary in the production of finished parts from individual castings, from short bronze bars, and from Permite 6-foot bars. Comparative data on costs and production time are given.

Thread-Cutting Machines and Tools

GEOMETRIC TOOL CO., New Haven, Conn. Bulletin illustrating and describing Geometric rotary and stationary, self-opening die-heads with circular or tangent chasers. Leaflet illustrating and describing Geometric solid adjustable die-heads with plain shanks and with threaded back parts. Leaflet descriptive of the Geometric No. 12 threading machine, a hand-operated machine for general-purpose work.

Zinc-Base Die-Castings

APEX SMELTING CO., 2554 Fillmore St., Chicago, Ill., is publishing a series of charts known as *Metalgrams*, containing data on zinc-base alloy die-castings, including new developments and tests made on the physical properties, as well as other research work. *Metalgram* No. 1 gives the tensile strength of the No. 2 zinc-base die-cast alloy for different die temperatures and pressures.

Motor-Driven Milling Attachments

DALRAE TOOLS CO., Syracuse Bldg., Syracuse, N. Y. Circular outlining the advantages and principal features of the Dalrae "Speedmill," a light-weight, powerful, motor-driven milling attachment which is especially adapted for small end-mill operations. The attachment is made in two sizes of 1/4 and 1/2 horsepower, with maximum capacities of 5/8 inch diameter in steel and 1 inch diameter in steel, respectively.

Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio. Catalogue containing information on automatic arc welding by the electronic tornado method. The catalogue gives physical properties of electronic tornado welds, procedure, speeds, and costs in employing this method, and applications in various

industries, including the automotive industry, pipe manufacture, steel barrel manufacture, the railway field, shipbuilding, etc.

Universal Boring Machines

UNIVERSAL BORING MACHINE CO., Hudson, Mass. Catalogue illustrating and describing the new 400 Series Universal table type horizontal boring, drilling and milling machines, which are made with either a standard spindle speed range or a high-speed spindle speed range. Complete specifications are given for the Nos. 440 and 450 machines, and details on special measuring equipment and attachments are included.

Control Valves

C. B. HUNT & SON, 4000 E. State St., Salem, Ohio. Catalogue describing the "Quick-As-Wink" line of air and hydraulic valves, designed to give instant and smooth control. The principle of construction of these valves is described, and complete specifications for the various sizes of hand-, foot-, solenoid-, and diaphragm-operated valves are given. Tables of dimensions for installation are included.

Gear Shapers

FELLOWS GEAR SHAPER CO., 78 River St., Springfield, Vt. Catalogue illustrating and describing in detail Fellows gear shapers, burnishing machines, lapping machines, sharpening machines, and testing and measuring machines. The final chapters of the book give data on Fellows gear shaper cutters, including standard blank designs, gear tooth proportions, etc., and burnishing gears.

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin covering GE equipment for machine tools, including motors, switches, push-button stations, etc. Bulletin GEA-1427D, illustrating and describing general-purpose automatic time switches made in two types for indoor and outdoor service. Bulletin GEA-246D, on high-speed, synchronous, two-phase and three-phase motors.

Alloy Cast Iron

BETHLEHEM STEEL CO., Bethlehem, Pa. 24-page illustrated booklet, 54-B, entitled "Silvery Mayari Alloy Iron," giving information about Silvery Mayari, a natural nickel-chromium iron with high silicon content. Although compiled expressly for the foundryman, it contains important information for all users of foundry products interested in high-strength, machineable castings.

Roller Bearings

TIMKEN ROLLER BEARING CO., Canton, Ohio. Leaflet descriptive of the new mirror finish applied to Timken bearings—the most highly accurate finish yet attained in this class of work. The booklet also describes the principle of operation of the profilograph, an instrument especially developed to measure the quality of finish on Timken bearings.

Precision Tools and Machines

EX-CELL-O AIRCRAFT & TOOL CORPORATION, 1200 Oakman Blvd., Detroit, Mich. Catalogue covering the Ex-Cell-O line of precision products, including thread-grinding machines, boring machines, carbide tool grinders, hydraulic power units, high-production special multiple equipment, drill jig bushings, milling cutters, counterbores, broaches, etc.

Power Press Clutches

NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo, N. Y. Circular illustrating and describing the construction of the new Niagara fourteen-point engagement sleeve clutch developed for use on Niagara presses. The advantages claimed for the new design are safety, long life, instant engagement, and low maintenance cost.

Shears

CINCINNATI SHAPER CO., Cincinnati, Ohio. Catalogue S, illustrating and describing the features of construction of the Cincinnati all-steel shears, which are made in a wide line of types and sizes to suit the requirements of all classes of work. Tables giving capacities and dimensions of the complete line are included.

Belting

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN, INC., Passaic, N. J. Circular 6808-B, describing the principle of the Condor Compensated belt and explaining the details of construction. Charts showing the performance characteristics of these belts compared with standard rubber belts are included.

Laboratory Equipment

GAERTNER SCIENTIFIC CORPORATION, 1201 Wrightwood Ave., Chicago, Ill. Bulletin 134, descriptive of Spectrophotometer assemblies for determining absorption and deflection coefficients. Bulletin 135 on the Michelson interferometer and accessories. Bulletin 136, descriptive of comparators of recent design.

Experimental Work-Shop Equipment

GLASCOCK BROS. MFG. CO., Muncie, Ind. Circulars describing "Metal Master" machines for the experimental and home work-shop, including a universal metal former, a spot-welder, a motor-driven jig shear, paint-spraying equipment, forming rolls, and other tools.

Threading Machines

ACME MACHINERY CO., Cleveland, Ohio. Bulletin descriptive of the Acme Model 35 threading machine, which can be equipped either for production work or short runs. Specifications covering capacity, dimensions, horsepower of motor, and other details for the three different sizes are included.

Flexible Couplings

JOHN WALDRON CORPORATION, New Brunswick, N. J. Catalogue illustrating and describing the important changes recently made in the Francke flexible couplings. Complete tables of sizes for the various types are given, together with full directions for size selection and coupling service factors.

Lubricants

GRAFO LUBRICANTS CORPORATION, Sharon, Pa. Booklet treating of the purpose and application of colloidal graphite lubricants. The characteristics of two of these lubricants, known as "Grafolube" and "Grafolene," and the applications for which each is especially suited are described.

Hydraulic Feeds and Controls

VICKERS, INC., 1400 Oakman Blvd., Detroit, Mich. Bulletin illustrating machines exhibited at the recent Machine Tool Show that were equipped with hydraulic feeds and controls made by this company. The examples shown give a good idea of the wide applicability of this equipment.

Variable-Speed Control

REEVES PULLEY CO., Columbus, Ind. Booklet T-7025, describing how several machine tool users have in-

creased productive efficiencies by the use of modern variable-speed control. Typical applications of speed control equipment are shown, and the operating principles are discussed.

Everdur Metal

AMERICAN BRASS CO., Waterbury, Conn. Publication E-4, describing the welding properties of Everdur metal and welding procedure for metal thicknesses up to and including 3/16 inch and for metal thicknesses over 3/16 inch. Information is also given on welding Everdur to steel.

Laminated Bakelite

SYNTHANE CORPORATION, Oaks, Pa. Folder describing the properties, mechanical applications, and methods of machining Synthane Laminated Bakelite. Among other mechanical applications, the folder describes the use of this material for eliminating noise in gears.

Indicating, Recording, and Controlling Instruments

BROWN INSTRUMENT CO., Philadelphia, Pa. Catalogue 8900, on Brown air-operated controllers for the control of temperature, pressure flow, and liquid level. Booklet 89-1, announcing the introduction of the air-operated controller.

Reamers

PRATT & WHITNEY CO., Hartford, Conn. Circular 411, descriptive of the construction and advantages of Pratt & Whitney "Camlock" adjustable serrated-blade reamers, which are suitable for both high production jobs and accurate finishing operations.

Laboratory Instruments

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y. Folder descriptive of the new Bausch & Lomb grain size measuring eye-piece for the quick, easy, and accurate determination of grain size according to the A.S.T.M. numerical index.

Buffs

UDYLITE CO., 1651 E. Grand Blvd., Detroit, Mich. Circular announcing Udylite humidified buffs, which are given a special treatment that provides proper moisture content for maximum strength and wear-resisting qualities.

Screw Steels

UNION DRAWN STEEL CO., Massillon, Ohio. Circular entitled "What Hundreds of 'Automatic' Operators Have Learned About Tool Life," describing actual experiences in reducing tool costs with Union Bessemer screw steels.

Die Coating and Mold Dressing

ST. JOHN X-RAY SERVICE, INC., 30-20 Thomson Ave., Long Island City, N. Y. Leaflet referring to "Bonis," a die coating and mold dressing material for non-ferrous die and permanent mold castings.

Bolt Anchors

RAWLPLUG CO., INC., 98 Lafayette St., New York City. Booklet describing the design and application of "Rawl-Anchor"—a bolt anchor especially intended for concrete, brick, and similar hard materials.

Shop Trucks

BARRETT-CRAVENS CO., 3255 W. 30th St., Chicago, Ill. Catalogue illustrating and describing the company's line of lift trucks, reel trucks, platforms, portable elevators, barrel trucks, and storage racks.

Electric Tools

BUCKEYE PORTABLE TOOL CO., Dayton, Ohio. Catalogue of Hercules high-frequency electric tools, listing many new models of drills, grinders, buffers, sanders, polishers, nut runners and screwdrivers.

Welding Rod

AMERICAN MANGANESE STEEL CO., Chicago Heights, Ill. Folder on the application of Amsco nickel-manganese steel welding rod, together with suggestions for welding with this type of rod.

Bench Power Presses

WATERBURY FARREL FOUNDRY & MACHINE CO., Waterbury, Conn. Folder illustrating and describing safety bench power presses for light assembling, riveting, and foot-press work.

Electric Tools

INDEPENDENT PNEUMATIC TOOL CO., 600 W. Jackson Blvd., Chicago, Ill. Catalogue 32, illustrating and giving specifications for the entire line of Thor universal electric tools.

Industrial Rubber Tires

B. F. GOODRICH CO., Akron, Ohio. 24-page "Handbook of Industrial Tires," emphasizing the value of rubber tires on industrial trucks and factory transportation equipment.

Filters

T. SHRIVER & CO., Hamilton St. and Franklin Ave., Harrison, N. J. Bulletin 103, describing the principle of operation of Shriver filters and their application in electroplating.

Air Compressors

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Circulars W850-B48, B49, B50, and B51, dealing with gasoline-engine driven portable air compressors.

Drafting Tables

GRAFION & DUFLAT, INC., 220 E. 42nd St., New York City. Bulletin describing the new Grafion drafting table and Duflat drafting papers that remain flat permanently.

Electric Contactors

ELECTRIC CONTROLLER & MFG. CO., Cleveland, Ohio. Folder 1145, descriptive of a complete new line of electric contactors for machinery, crane, and mill controllers.

Tapered Roller Bearings

TYSON ROLLER BEARING CORPORATION, Massillon, Ohio. Circular illustrating and describing in detail the features of design of Tyson cageless tapered roller bearings.

Vulco Rope Drives

GATES RUBBER CO., 999 S. Broadway, Denver, Colo. Circular illustrating the construction of the Gates Vulco rope drive, a V-belt with a patented concave side.

Electric Furnaces

AJAX ELECTROTHERMIC CORPORATION, Ajax Park, Trenton, N. J. Bulletin 9, illustrating and describing a new line of small electric furnaces for laboratory use.

Files

HELLER BROS. CO., Newark, N. J. Folder entitled "Again Heller Leads with a Nucut File," outlining the characteristic features of this type of file.

Rotary Table for Jig Borer

PRATT & WHITNEY CO., Hartford, Conn. Circular 417, illustrating and describing a 10-inch tilting rotary table for the company's No. 1A jig borer.

Lighting Equipment

EDWIN F. GUTH CO., St. Louis, Mo. Catalogue 28, illustrating different types of indirect lighting equipment for industrial use.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Three Recent Lodge & Shipley Developments

Spindle speeds that are infinitely variable within a minimum range of 400 to 2400 revolutions per minute and a maximum range of 600 to 3600 revolutions per minute are provided on a high-speed lathe exhibited for the first time at the Cleveland Show by the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio. One of the important features of this lathe, which is shown in Fig. 1, is that it is driven by a New Departure Transitorq variable-speed unit. Units of 5, 7 1/2, or 10 horsepower can be provided.

The spindle speeds are changed instantly by means of a handwheel on the front of the headstock, while a lever on the headstock is used to place the spindle in neutral. At the right-hand end of the apron is a lever control for starting and stopping the spindle rotation. The spindle runs in preloaded ball bearings.

Four feed ranges of 0.0001 to 0.0016 inch, 0.001 to 0.016 inch, 0.002 to 0.032 inch, and 0.004 to 0.064 inch can be furnished. Either multiple or single automatic feed-length stops can be provided, as well as single- or multiple-diameter stops of micrometer type. The feeds are changed at the apron, which is equipped with a six-feed selection mechanism. The tailstock is supplied with a revolving center.

Automatic lubrication is provided for the headstock, feed mechanism, apron, carriage, and tool-rest. At the right-hand end of the bed is an open impeller type of centrifugal pump with a capacity of 25 gallons a minute, while the base contains a reservoir holding 30 gallons of cutting compound. This machine has a swing of 16 1/2 inches over the bed and 10 1/2 inches over the compound rest and carriage. The distance between centers is 30 inches.

Two other new machines introduced at the Show by this concern were the No. 1 Duomatic, illustrated in Fig. 2, which is designed for the high-speed quantity production of the smaller classes of work, and the No. 5 Duomatic, illustrated in Fig. 3, which is specifically intended for the heavy-duty field. These machines supplement the general-purpose No. 3 Duomatic brought out by the company a number of years ago.

A distinctive feature of the No. 1 Duomatic is its complete electrical control. There are no levers on the front of the machine for starting or stopping, or for other purposes. A push-button is simply depressed to start the machine after the work has been loaded. When the operation is finished and the tools have returned to their starting

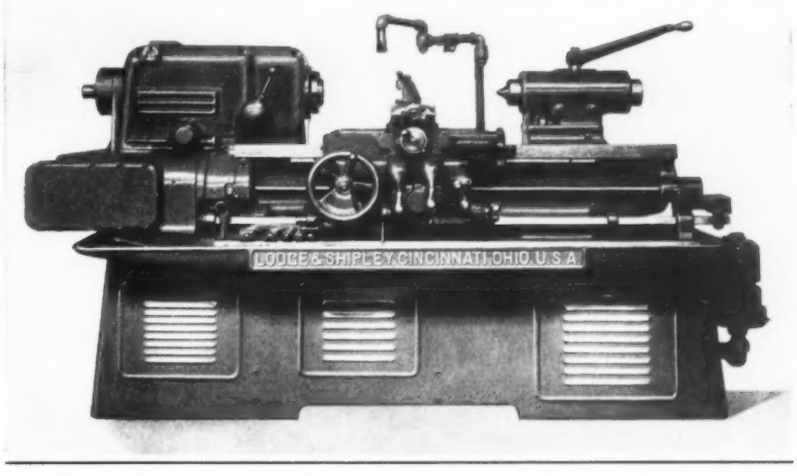


Fig. 1. Lodge & Shipley High-speed Lathe Equipped with a New Departure Transitorq Variable-speed Unit

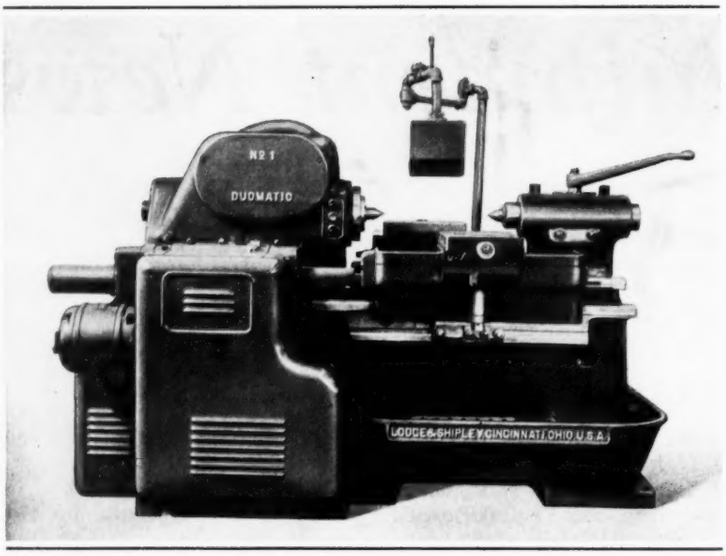


Fig. 2. Duomatic with Complete Electrical Control Intended for the High-speed Production of the Smaller Classes of Work

positions, the entire machine, including the work-spindle, stops automatically.

Push-buttons are also provided for stopping or reversing the machine either during a feed or a rapid traverse. This arrangement saves considerable time in setting up a job, and, in addition, provides a safety means. The electric control of this machine has the additional advantage that it permits the rapid handling of the tools during their idle movements. This is done without sacrificing accuracy of the work, since the feeding movement during cutting is obtained mechanically.

The No. 5 Duomatic is provided with a hydraulic tool control, by means of which the correct rate of feed can be conveniently obtained for any particular job. Also, the rate of feed can be changed automatically during an operation to suit the nature of the cut. This feature is of particular importance with the diversified nature of heavy work for which the machine is intended, since it permits the constant removal of metal at the maximum rate. The machine is not limited to a specific high-production job, as it is readily adapted for different jobs with minimum change-over time.

The No. 1 Duomatic has a swing of 16 inches over the bed and 10 inches over the tool-slides. The distance between centers with a bed of basic length is 15 inches, but longer beds can be provided. The No. 5 Duomatic has a swing of 24 inches over the bed and 16 inches over the tool-slides. The distance between centers on this machine equipped with a bed of basic length is 30 inches.

GE Push-Button and Rotating-Drum Switches

A line of water-tight push-button master switches, mounted in molded phenolic-compound enclosures and intended for naval type installations or equivalent industrial applications, has been announced by the General Electric Co., Schenectady, N. Y. Each unit is operated by a molded-compound lever, which protects the operator from electrical contact with metal parts. As many as four of these units can be mounted in one enclosure. These switches, known as CR2940, provide both normally open and closed circuits.

Two new lines of rotating-drum switches, one for multi-speed use and the other for reversing applications, have also been announced. These CR3300 switches can be either wall- or flange-mounted for built-in applications. The reversing switches have a self-locking cam for positioning, but are easily adjusted for spring return or for maintaining contact in either position. They are suitable for single-, two- or three-phase current reversing or non-reversing motors, and for two-speed non-reversing motors where an off-position contact is not required.

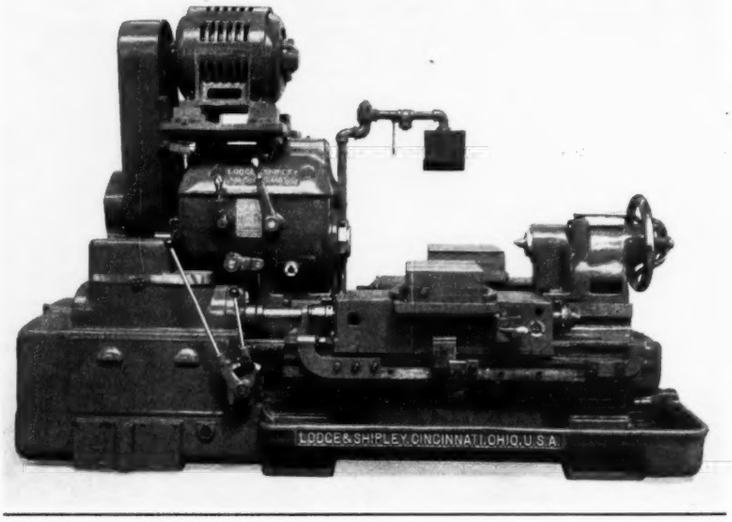


Fig. 3. Duomatic with a Hydraulic Tool Control which Adapts it for Handling Heavy-duty Work

Fig. 1. Gardner Single-spindle Disk Grinder Driven by Standard Motor

Gardner Single-Spindle and Horizontal Disk Grinders

A line of motor-driven single-spindle disk grinders known as the 200 series is being introduced on the market by the Gardner Machine Co., Beloit, Wis. This line was developed with two main purposes in mind—first, to provide disk grinders driven by a standard motor mounted on a bracket at the rear of the base rather than by a special built-in motor; and second, to make available machines of increased sturdiness having a number of mechanical improvements. With the motor mounted at the rear of the base, these machines can be readily operated at the spindle speeds necessary to give the desired peripheral speed of the disk.

The spindle of these machines is ground to insure true running balance. It is mounted in two pillow blocks, each of which is equipped with two preloaded ball bearings. One pillow block is clamped in position, but the other is allowed to float endwise, so as to take care of spindle expansion and contraction. The entire spindle, together with the pillow blocks, can be easily removed as a complete unit when necessary.

The bracket on which the motor is mounted is hinged to provide for regulating the tension of the multiple V-belts used in driving the machine. Universal lever-feed tables or plain worktables can be provided. Safety hoods constructed of welded steel plate according to specifications of the American Standards Association are supplied if desired. These hoods are built in two sections, which are so mounted on a large flange that they can be easily adjusted to compensate for wear of the abrasive member. There are four sizes in this line of disk grinders, with disk wheels from 10 to 30 inches in diameter or ring-wheel chucks from 8 to 24 inches in diameter.

The same concern has also brought out two new types of the No. 24 53-inch horizontal disk grinders. The type shown in Fig. 2 is supplied with a vertical built-in shaftless motor, while the type illustrated in Fig. 3 is driven by a flanged motor mounted in a horizontal position. Power is transmitted

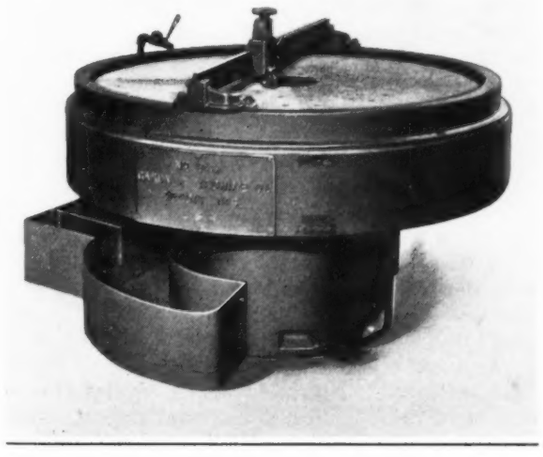


Fig. 2. Horizontal Disk Grinder Driven by Vertical Built-in Shaftless Motor

Fig. 3. Horizontal Disk Grinder Driven by a Flanged Motor Mounted Horizontally

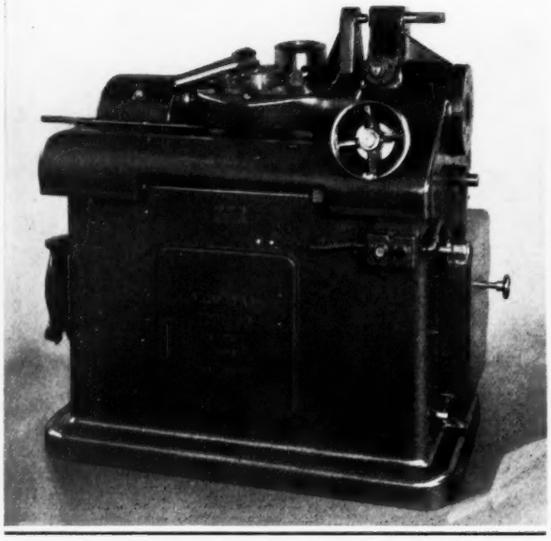


Fig. 1. Gear-tooth "Shaving" Machine Brought out by the Michigan Tool Co. for Internal Gears

Fig. 2. The Internal Gear Finishing Machine Operates on the Crossed-axes Principle

from this motor to the vertical spindle through spiral bevel gears.

On each machine, the rated load of the thrust bearing at the base of the spindle is over 22,000 pounds, which is many times in excess of the load that the machine would be required to carry. Both machines are designed to use Gardner Wire-Lokt heavy-duty abrasives. When the machines are to be used for wet grinding, a separate settling tank is furnished.

Industrial Brake Lining

A new type of brake lining known as "Thermoid BX Woven," developed for use on heavy industrial machinery and equipment, is announced by the Thermoid Rubber Co., Trenton, N. J. This brake lining has as its base an asbestos tape that is woven in a single thickness, and therefore has no plies that may separate under severe service conditions. The tape is woven from heavy yarn containing brass wire and is impregnated with a highly heat-resistant Bakelite resin. The resultant product is a dense, flexible material consisting of 70 per cent asbestos and 30 per cent resin.

Finishing Machine for Internal Gears

The Michigan Tool Co., Detroit, Mich., has developed a machine for finishing internal gears which operates on the same fundamental shaving principle as the crossed-axes machines built by the concern for finishing spur and helical gears. The internal gear to be finished is mounted in a pot chuck which is fitted with adapters that can be varied to take almost any normal size of internal gear. For gear teeth of relatively fine pitches, laminated cutters seem to be most satisfactory, while for gears of 8 diametral pitch or coarser, solid cutters with serrations cut in can be used.

The finishing cutter is mounted on a vertical arbor, as seen in Fig. 2, which, in turn, is mounted in an eccentric holder. As the cutter-arbor rotates and drives the internal gear (which is free to turn with its adapter on roller bearings), the arbor holder slowly revolves eccentrically, so that the arbor itself moves gradually along an arc as it approaches and passes along the internal gear. At the center point of this arc, which is the closest approach of the arbor to the internal gear, the pitch circles of the cutter teeth and the internal gear teeth coincide and the maximum depth of cut is reached.

After the cutter passes the center point of the arc, the cutter again moves away from the gear. When it reaches the end of this travel, the machine reverses automatically and then the arbor travels backward through the same arc as before. However, while the flanks on the back side of the internal gear teeth are finished on the forward travel of the cutter, the flanks on the forward side of the teeth are shaved on the return travel.

The axes of the arbor and internal gear are at an angle to each other. This angle is adjustable for either large or minute amounts. The crossed axes result in a relative sliding motion of the cutter and work teeth lengthwise of the teeth, thus producing the shaving action directly across the flank.

The length of arc is also adjustable, together with the rate of feed and the point of automatic stopping and reversing. The table which carries the pot chuck is adjustable for various center distances between gear and cutter. All adjustments can be checked by means of graduations or by using a sine bar.

Schatz Punch Press with Indexing Turret

A multi-tool punch press being introduced on the market by the Schatz Mfg. Co., Poughkeepsie, N. Y., is equipped with a turret that is revolved or indexed by power to bring any desired tool into the working position by simply depressing a foot-treadle. The turret may be provided with from six to twelve tool-slides, depending upon the size of the machine. The turret enables the complete punching, pressing, shearing, bending, straightening, forming, etc., of a part in one set-up, even though as many as twelve operations must be performed.

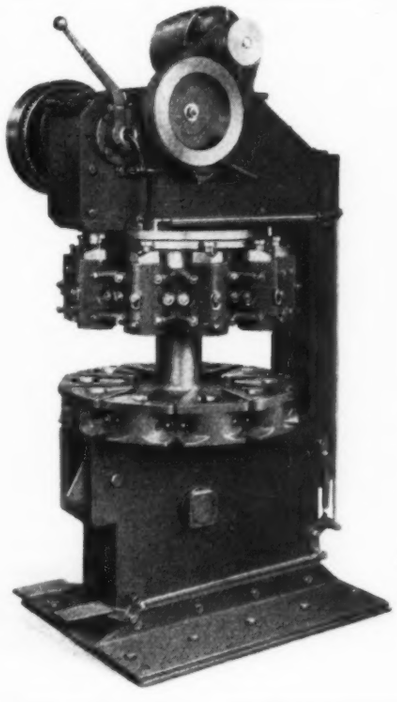
The frame of this machine is constructed of rolled steel plates. The upper tools are provided with guides that are adjustable vertically to such an extent that they can be lowered close enough to the lower dies to eliminate the necessity of using strippers in many cases. By merely operating a lever, the upper tools can be lowered rapidly to the work, so as to facilitate setting or matching the tools. A simple method of fastening the tools is employed.

This machine is built in five sizes with a ram pressure of from 17 to 130 tons. The throat depth is 8 3/4 inches on the smallest size and 14 3/4 inches on the largest size. The machine operates at from 100 to 75 strokes a minute, according to the size. Multiple V-belts transmit the power from the motor.

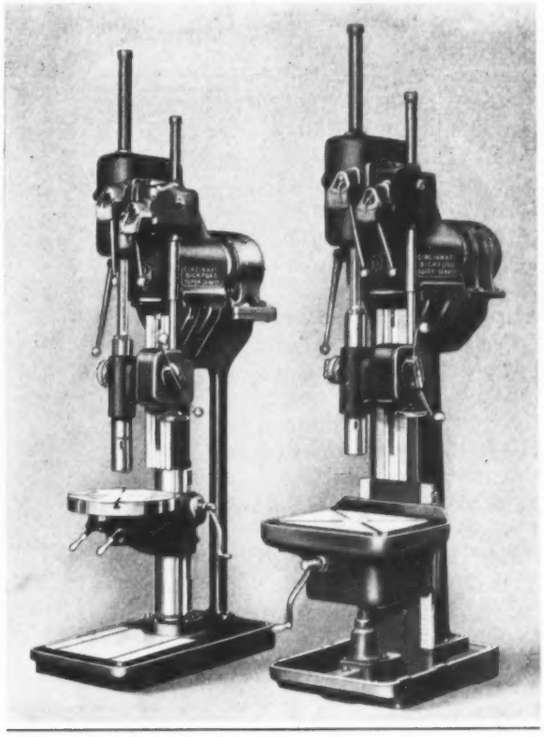
Cincinnati-Bickford Improved "Super Service" Upright Drilling Machines

Important improvements were incorporated in a new line of "Super Service" upright drilling machines introduced at the Cleveland Show by the Cincinnati Bickford Tool Co., Oakley, Cincinnati, Ohio. This line includes 21-, 24-, and 28-inch machines of both round- or box-column styles, as shown in the illustration. The 24- and 28-inch machines provide twelve speeds ranging from 60 to 1000 revolutions per minute or from 90 to 1500 revolutions per minute, and nine rates of power feed. All speed changes are made through a single lever, and the feeds are similarly controlled. Direct-reading plates enable any speed or feed to be obtained almost instantly. The 21-inch machine provides nine speeds in any one of five ranges and four rates of power feed.

One of the new features of these machines is the provision of a reversing motor for tapping operations instead of mechanical reversing clutches. This eliminates a previous costly mechanism that required frequent adjustment. The forward rotation, reverse rotation, and stopping



Schatz Punch Press Equipped with Turret for Performing a Series of Operations



Two Upright Drilling Machines of the Improved Cincinnati-Bickford "Super Service" Line

of the spindle are controlled through the lever at the left of the head. Power is supplied by a standard constant-speed motor suitable for making about twenty reversals a minute in conjunction with a magnetic reversing starter.

The spindle is mounted in anti-friction bearings. Both the rack and the rack pinion are 50 per cent stronger than in the previous design, and all possibility of damage to these parts has been eliminated by the provision of a spring bumper which cushions the spindle return. Anti-friction bearings are also provided for the feed gearing.

These machines can be furnished to suit individual requirements as to multiple drill heads, a flanged spindle sleeve, an auxiliary guide for rigid drill-head mounting, and automatic spindle return. They are also available in gang constructions.

Stanley Portable Unishear

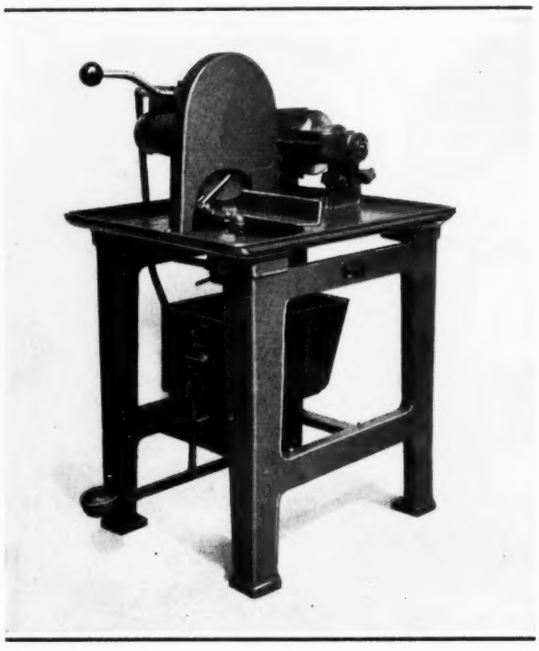
Sheet steel up to No. 16 gage can be cut by a portable electric Unishear recently brought out by the Stanley Electric Tool Division, New Britain, Conn. This equipment is similar in appearance to the 18-gage "Mighty Midget" built by the concern, but it is of heavier construction and has almost twice as much power as the previous machine.

Stock can be fed through this machine at speeds up to 15 feet a minute for cutting to angles, curves, circles or straight lines. Inside cuts can be easily made after punching a 2-inch hole to receive the yoke. Circles or curves can be cut to radii as small as 1 1/2 inches. This equipment is 13 1/2 inches long, and weighs only 10 1/4 pounds.

White Abrasive Cut-Off Machine

A machine designed primarily for cutting off plastic materials in rod and bar form by means of an abrasive wheel, but which can also be used for cutting off small steel bars, is being placed on the market by the White Engineering Laboratories, Inc., Paterson, N. J., R.F.D. No. 1. While the illustration shows a belt-driven machine, a compact motor drive can be furnished. Bars of stock can be cut off either dry or under the flow of water. When water is used, it is automatically shut off by the raising of the wheel arm.

The wheel arm can be operated either by a foot-treadle or by hand, but when a foot-treadle is used for clamping the work, it is more convenient to actuate the cutting-off mechanism by hand. The wheel guards can be arranged to suit different widths and diameters of single or multiple wheels. Ball-bearing mountings are provided for all moving parts of the machine. Plastic materials up to 2 1/2 inches in diameter can be cut off.



Abrasive Cutting-off Machine for Plastic Materials and Small Bars of Steel

Hand-operated Hoist with a Steel Cable and Winding Drum

Shaw-Box Hand-Operated Hoists

Hand-operated hoists for use where head-room is limited have recently been designed by the Shaw-Box Crane & Hoist Co., Inc., Muskegon, Mich., in capacities of 1/2, 1, and 2 tons. These hoists are mainly intended for use in connection with an overhead I-beam track or a single girder crane. They are equipped with anti-friction bearings in all load-carrying parts, so that one man can handle the loads with ease.

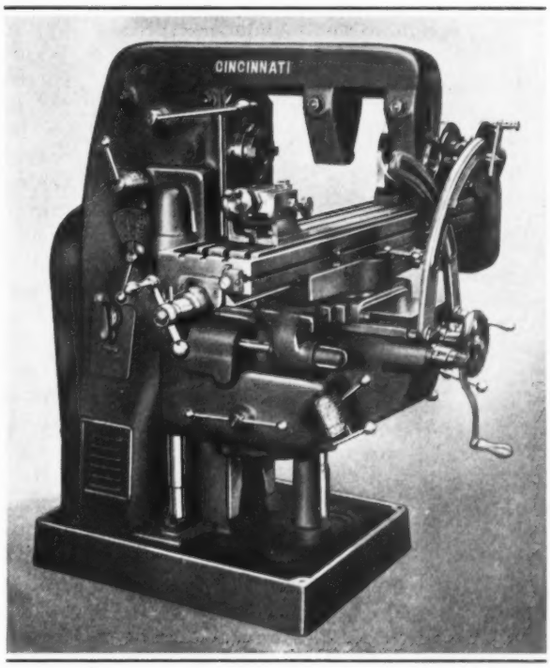
The frame is built entirely of steel members, arc-welded together to form a rigid one-piece unit. The trolley is built integral with the hoist frame and is equipped with wheels that rotate on radial ball bearings. Loads are raised and lowered by pulling on a hand chain which drives a winding drum through a self-locking worm-gear reduction unit. A steel cable carries the load. The worm-gear reduction unit will hold the load in any position and prevent too rapid raising or lowering.

Cincinnati No. 2 L-Type Universal Milling Machine

One of the interesting exhibits of the Cincinnati Milling Machine Co., Cincinnati, Ohio, at the recent Machine Tool Show, was a tool-room milling machine especially designed for handling job-shop quantities of the average type of milling machine work. This machine has fifteen spindle speeds ranging from 23 to 1200 revolutions per minute. Selection of the speeds is effected through two levers on the left-hand side of the column. All teeth of the gears in the drive to the spindle are finished after heat-treatment to insure quiet operation at all speeds.

Feed rates are selected by shifting two levers on the left-hand side of the knee. Twelve feeds are available, the longitudinal travel ordinarily ranging from 3/4 inch to 30 inches per minute, but a lower feed series can be provided. The feeds can be engaged from the front or from the rear working position with the spindle stationary, running, or actually taking a cut. Power rapid traverse is available in six directions, the longitudinal travel being at the rate of 100 inches a minute. Immediately upon the release of the rapid-traverse lever, the motion of the unit that is being rapidly traversed is changed to a feed rate.

A three-horsepower motor enclosed in the column drives the machine through V-belts. The motor is accessible through a hinged cover at the rear of the column. The spindle mounting consists of a double-row anti-friction front bearing and an anti-friction self-compensating rear bearing. A multiple-disk brake instantly stops the spindle when the starting lever is disengaged. The direction of spindle rotation can be reversed by means of a lever on the side of the column, which is operated to stop, reverse, and start the motor. This eliminates the need of reversing gears.

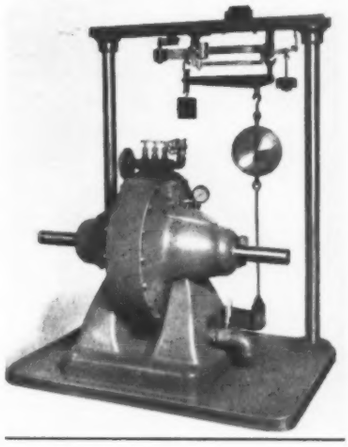


Cincinnati Universal Milling Machine Recently Brought out for the Average Run of Work

Taylor "Hi-Eff" Dynamometer

The high-speed dynamometer here illustrated has been added to the line of the Taylor Mfg. Corporation, 2330 W. Clybourn St., Milwaukee, Wis., which now includes dynamometers having capacities from 1/10 to 10,000 horsepower and speeds from 0 to 25,000 revolutions per minute. This new Hi-Eff dynamometer has a heavy one-piece base, over-size ball bearings, and precision-balanced alloy rotors, designed for testing high-speed prime movers and production-line loads.

Machines of this type are being built for several automobile, tractor, piston-ring, V-belt, and marine-engine builders. Optional equipment includes tachometers, beam scales, revolution counters, fuel-weighing units, engine supports, bedplates, couplings, and an automatic control.

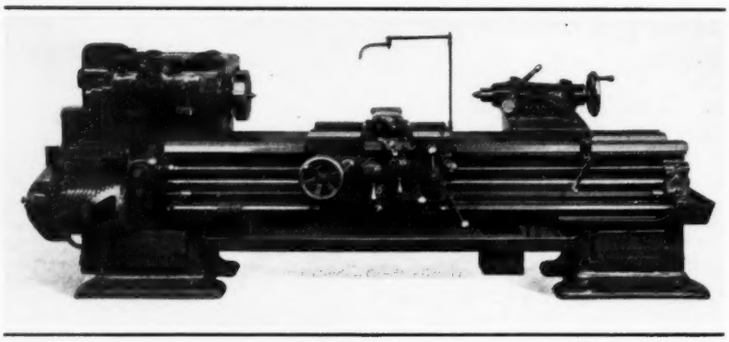


Taylor High-speed Type Dynamometer

Duro-Brace Texsteel Sheaves

Light weight, strength, and pleasing appearance are features of the Duro-Brace Texsteel sheaves for V-belt drives, to which additional stock sizes have just been added by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. The new sheave sizes make it possible to furnish these drives in capacities up to 15 H.P. The grooves of the sheaves are designed for use with A-section belts of 1/2 by 11/32 inch size or B-section belts of 21/32 by 7/16 inch size.

The line includes twenty-five diameters, ranging from 3 to 18 inches, with from two to six grooves. All sheaves are available with interchangeable type hubs, carried in stock with bores in 1/16-inch increments from 1/2 inch up to the maximum size.



Springfield Engine Lathe Designed for Heavy Cuts with High-speed Steel and Fast Cuts with Carbide Tools

Springfield Heavy-Duty Ball-Bearing Geared-Head Engine Lathe

A 20-inch engine lathe designed for taking heavy cuts with high-speed steel and high-speed cuts with carbide tools was demonstrated at the Cleveland Show by the Springfield Machine Tool Co., Springfield, Ohio. This machine is provided with Timken roller bearings for the spindle. The sixteen-speed headstock can be furnished with either helical or spur gears. The oil reservoir, instead of being located in the bottom of the headstock, as in previous designs, is now in the first pocket of the bed. Oil is pumped from the reservoir through filters and sprayed over the gears, shafts, and bearings of the headstock.

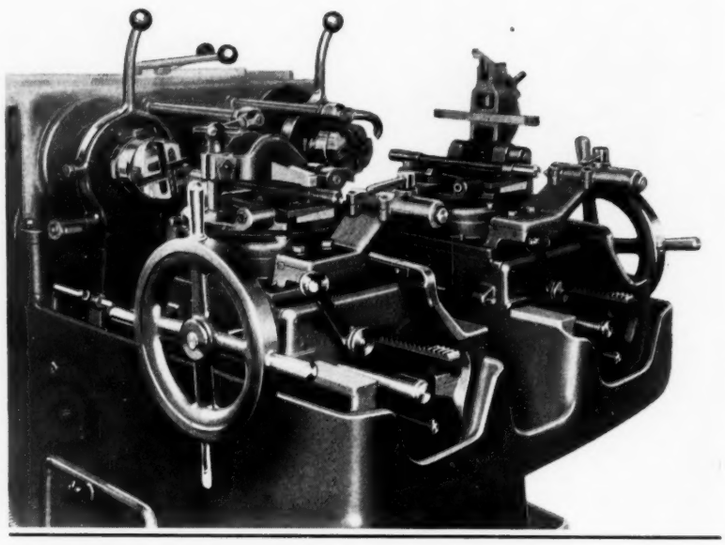
The reversing mechanism for the lead-screw is now mounted on the rear of the headstock, where it can be readily inspected. An important feature of this design is that it allows the use of much heavier gears and shafts than ordinarily. All gears run in ball bearings and in oil.

A new heavy-duty gear-box has been designed for this lathe which gives thirty-six changes of threads and feeds. The apron is also of new design, with a front plate that can be removed to permit convenient inspection of all working parts. This also makes a complete box construction of the apron unit possible, giving greater strength and accuracy. An oil-pump and reservoir in the apron lubricate all bearings of the apron, carriage, and lower slide of the compound rest.

The carriage and compound rest have been made longer and broader than usual, so as to enable them to carry unusually heavy pressures. The same thought was carried out in designing the tailstock. The bed is in proportion to all other units, weighing 290 pounds to the foot. It measures 20 1/4 inches across the vees. The lathe is driven by a 10-horsepower motor.

Work Aligning and Indexing Fixtures for Threading Machine

A fixture designed for application to the Landmaco threading machines has been developed by the Landis Machine Co., Inc., Waynesboro, Pa., for use in threading parts which require threads on each end that must be in accurate alignment and concentric with each other and the work. In addition to providing for accurate self-alignment, the fixture also indexes automatically, so that both ends can be threaded at one setting.



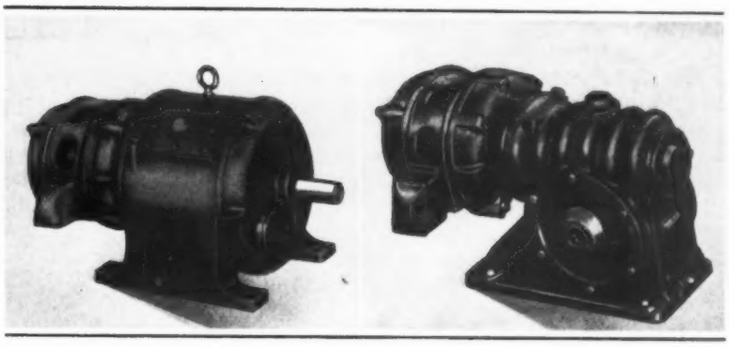
Self-aligning and Indexing Fixture Applied to Landmaco Threading Machine

While the machine is shown in the illustration set up for threading steel forgings approximately 15 inches in length, it can be readily adapted for other work of a similar nature. Each end of the work shown is threaded to a length of 1 3/4 inches. The concentricity of the pitch diameters of both threads with the center line of the work is held within 0.005 inch. The forgings are centered, and the surfaces to be threaded are turned and ground previous to the threading operation.

Diehl Helical and Worm Gear-Motors

A complete line of gear-motors and speed reducers in both helical- and worm-gear types is being placed on the market by the Diehl Mfg. Co., Elizabethport, N. J., in cooperation with the Foote Bros. Gear & Machine Co., Chicago, Ill. The line includes direct-connected and coupled types with single, double, and triple stages of reduction. Horizontal, vertical, or right-angle drives can be supplied.

The helical gear-motors are particularly adapted for drives of from 3/4 to 75 horsepower and for speeds down to 6 revolutions per minute on the slow-speed shaft when the units are driven by a motor running at 1750 revolutions per minute. The worm gear-motors are obtainable in capacities from 3/4 to 40 horsepower with slow-speed shaft speeds down to 30 revolutions per minute when a motor running at 1750 revolutions per minute is used. The illustration shows a helical gear-motor at the left and a worm gear-motor at the right.



Helical and Worm Gear Reducers Placed on the Market by the Diehl Mfg. Co.

Jones & Lamson Saddle Type Turret Lathe with Cross-Sliding Turret

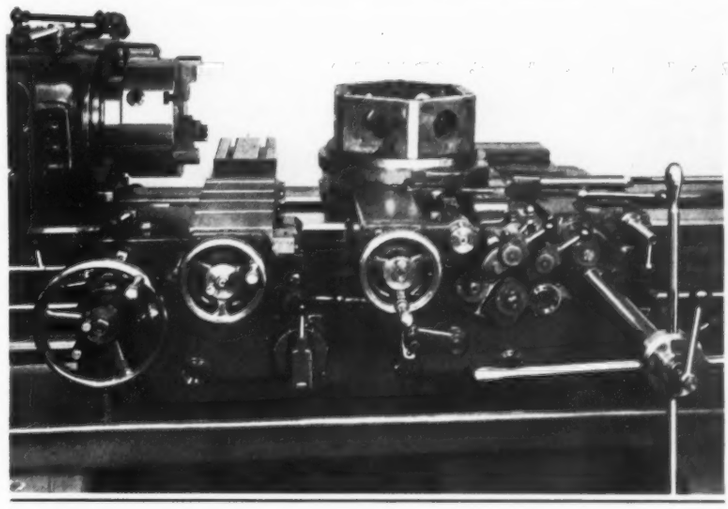
A 2 1/2- by 40-inch saddle type turret lathe with a fixed-center turret, recently designed by the Jones & Lamson Machine Co., Springfield, Vt., was described on page 18 in September MACHINERY. This turret lathe can also be provided with a cross-sliding turret of the design here shown. The turret may be either of the hollow-hexagon style or of the flat type.

Multiple stops are provided on the turret cross-slide for disengaging the feed in either direction. An automatic clamp ring is supplied for the turret. The saddle is equipped with automatic stops for the longitudinal movement. Six of these stops operate automatically, one for each turret position. Three additional stops that are manually operated can be supplied for any turret position.

Nine cross and longitudinal turret feeds are obtainable through a sliding gear transmission operated by means of a single-lever selector equipped with a direct-reading dial. All gears in the apron run in a bath of oil, and all parts of the saddle that are not oiled by the splash system are lubricated through a force-feed oiling system. This includes the ways of the machine and all bearings under the turret and on the cross-sliding unit.

The saddle is equipped with a power traverse which also provides for mechanical indexing of the turret. There are two rates of speed for this mechanism—one which is used in the rapid movements to and from the work, and a slower speed which is employed in indexing. The control lever for the power traverse and turret indexing is located in front of the star-wheel. The latter, which is used in operating the saddle manually, does not turn when the power traverse is engaged.

As explained in the previous description, this turret lathe is equipped with a twelve-speed headstock. All the transmission shafts are mounted in ball bearings, and the main spindle is



Cross-sliding Turret Available for Jones & Lamson Saddle Type Turret Lathe

also mounted in ball bearings, set up under a predetermined load. All speeds are obtained through a single-lever selector and a direct-reading dial. A single lever also controls the forward and reverse rotation of the spindle, and when this lever is moved to its neutral position, it automatically applies a brake to the spindle.

Three types of driving units can be furnished as standard equipment—a flange type motor, a V-belt drive from a motor mounted in the cabinet leg, or a countershaft drive. Nine reversible longitudinal and cross feeds are provided for the carriage, also through a single-lever selector equipped with a direct-reading dial.

Profiling Machine for Airplane Propellers

A machine designed for cutting the profiles on airplane propeller blades within an accuracy of 0.002 inch was recently built by the Engineering & Research Corporation, 6100 Sligo Mill Road, N.E., Washington, D. C. This machine profiles only one side of the blade at a time. The profile is controlled by a cast-iron master cam or form which is located directly in back of the cutter. The cutter reciprocates, oscillating freely about a trunnion which permits it to travel vertically in order to mill to the required contour.

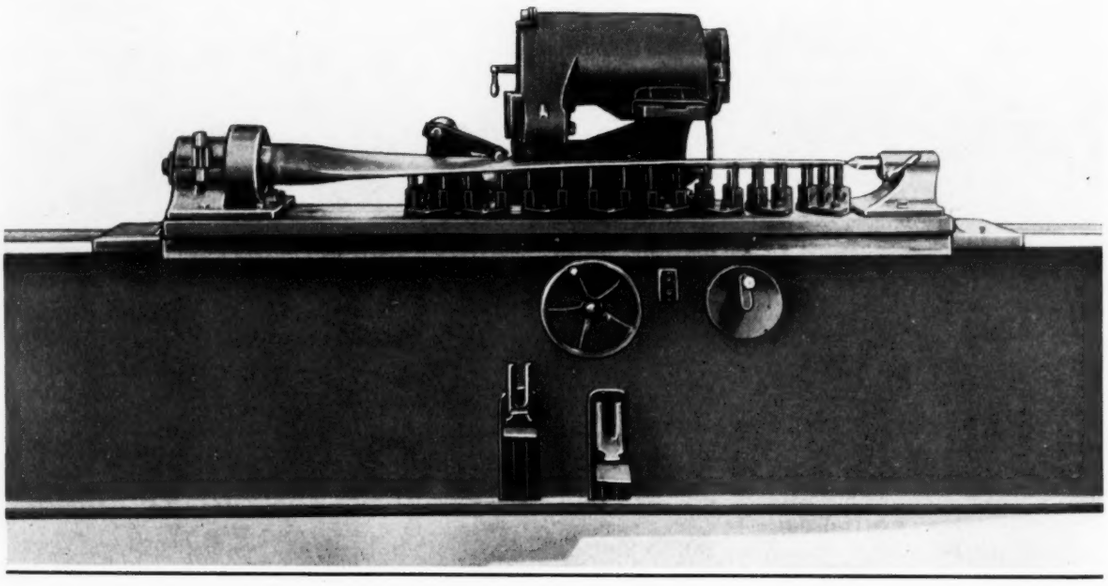
The table is fed horizontally to carry the cutter from the tip of the propeller blade to a point 18 inches from the hub. Here the cutter is lifted off and the machine stopped automatically. The table is then returned to the starting position by revolving a handwheel.

The cutter has a peripheral speed of about 5000 feet a minute. Metal can be removed in one cut to a depth of 3/8 inch, if necessary. The blade of a 10-foot propeller can usually be profiled within an hour to the accuracy mentioned, thus greatly simplifying balancing and interchangeability of blades.

The machine is built with a welded-steel base that was fabricated by Lukenweld, Inc., Coatesville, Pa. The ways are made of Lukens Cromansil steel. The welding was done with covered electrodes, and the finished base was relieved of stresses by heat-treatment before shipment. Although the bed is 13 feet long, 4 feet 9 1/2 inches wide, and 2 feet 9 inches high, it weighed only 3815 pounds before machining. Elimination of vibration was important in constructing the bed, because of the fine finish required on the propeller blades.

Niagara Inclinable Press of Improved Design

One of the important features of an inclinable press recently improved by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y., is a one-piece, high-tensile cast-iron frame that has been designed to insure rigidity and resistance to vertical, horizontal, and torsional stresses. Another feature is a fourteen-point engagement sleeve clutch which permits instant engagement and gives the maximum number of



Machine for Finishing Airplane Propeller Forgings, Equipped with a Welded-steel Base, Recently Built by the Engineering & Research Corporation

Niagara Inclinable Press with Important Improvements

strokes per minute. The fourteen engaging jaws eliminate time lag between the instant of depressing the treadle and the actual clutch engagement, thus insuring safety and a high productive output. As the jaws distribute the load over a striking surface of unusually large area, long life and a low maintenance cost are obtained. The construction permits the use of anti-friction bearings in the flywheel or main gear.

Power is transmitted to the 1 3/4-inch shaft of this inclinable press by twenty-six internal involute splines generated on the inside of the clutch sleeve, which engage corresponding external splines on the shaft. To prevent excessive forward drift of the shaft in the event that the brake is too loosely adjusted, and also to eliminate the possibility of the machine repeating under such a condition, the throw-out spindle encounters an abutment machined in the clutch sleeve which positively limits the shaft movement. A positive locking device prevents accidental engagement of the clutch in setting dies, while a non-repeat device prevents a second stroke of the slide, even if the treadle is held down. If desired, the single-stroke mechanism can be disconnected to permit continuous operation of the press.

The slide is equipped with the Niagara Breech-Block die clamp, which provides a solid support for the die under pressure. The die clamp is cylindrical in shape and is ground to close limits, so as to eliminate vertical play. It fits in a smooth bored hole, the center of which is sufficiently above the bottom of the slide to prevent the clamp from sagging. The motor for driving the press is located on top of the frame.

This press is equipped with a brake having a spring which automatically compensates for expansion due to heat of operation, as well as for wear.

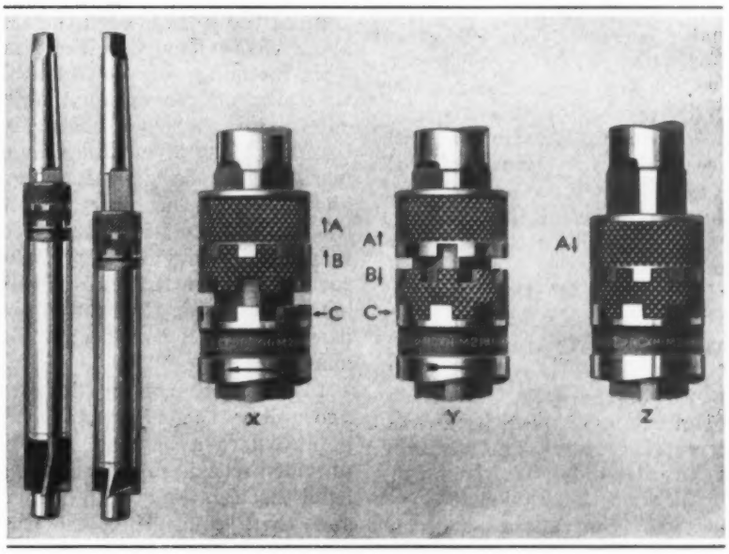
Eclipse Variable-Length Cutter-Holder with Accurate Adjustment Feature

Variable-length cutter-holders have recently been brought out by the Eclipse Counterbore Co., 7410 St. Aubin Ave., Detroit, Mich., which are adjustable for length in increments of 0.001 inch. These holders are specially adapted for multiple-spindle operations in which several holes must be faced, counterbored, or countersunk to identical depths. They eliminate the necessity of maintaining cutters sharpened in sets of the same exact length.

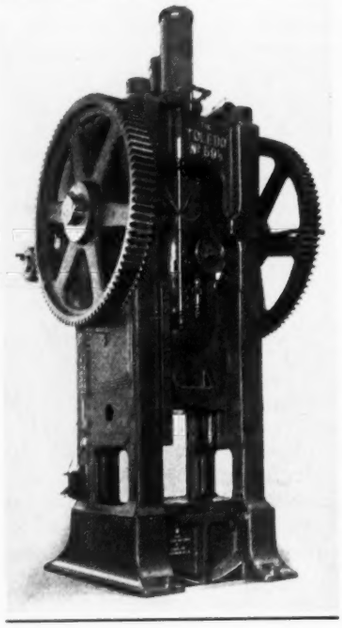
At the extreme left in the illustration is shown a holder fitted with a new cutter. At the right of this holder is another holder with a cutter that has been resharpened several times. It will be seen that the second holder has been adjusted to the same length as the first one.

The fine adjustment of this holder is obtained through a compensating collar which has driving lugs at both ends. The number of lugs at the upper end of the collar differs from the number of lugs on the lower end, which engages the body of the holder. The adjustments are positive and fool-proof and can be made almost instantly by hand.

In making an adjustment, collars *A* and *B* are raised together, as shown in view *X*, and the holder body *C* is turned ahead one notch. Collar *B* is then lowered, as indicated in view *Y*, and this collar is turned backward one notch, together with the holder body. Collar *A* is finally lowered into the locked position, as indicated in view *Z*.



Variable-length Cutter-holders, and Partial Views Illustrating Method of Adjustment



Toledo Straight-column Press with Air Type Clutch Controlled by Electric Push-button

Toledo Straight-Column Press

A new series of straight-column presses designed with a view to obtaining a pleasing appearance has recently been placed on the market by the Toledo Machine & Tool Co., Toledo, Ohio. In designing these presses, particular consideration was given to selecting materials most suitable for the requirements. One of the presses of this series is shown in the illustration with the gear guards removed. It will be noted that there are no parts projecting beyond the base and that the machine occupies a minimum floor space.

Particular attention is called to the design of the crown, which has been heavily reinforced by extending the tie-rods through the top of the arch. The beds, uprights, and slide have also been strengthened. The diameter of the tie-rods has been increased, and the crankshaft is of the semi-eccentric type, with an extra large crankpin and heavy cheeks firmly supported close to the frame of the press. The clutch is of a new patented air type mounted in the flywheel. It is controlled by an electric push-button which enables the operator to start or stop the press at any point of the stroke or to "inch" the slide along when setting or testing dies.

The press illustrated has a 16-inch stroke with a 6-inch adjustment by power. The slide is 24 by 35 inches and is counterbalanced by two air cylinders at the top of the crown. The bed is 50 by 43 inches. The weight of the press is about 150,000 pounds. The machine is driven by a direct-connected motor.

Combination Filing and Sawing Machine of Band Type

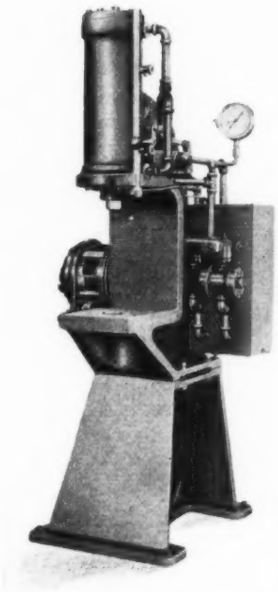
Both filing and sawing can be performed on a band type machine known as the "Do-All," which is being introduced on the market by Continental Machine Specialties, Inc., 1301 Washington Ave., S., Minneapolis, Minn. Less than three minutes is required to change the machine over from filing equipment to a sawing machine or vice versa. The machine is intended primarily for tool and die work, but it is applicable wherever it is necessary to cut out holes or shapes in flat material.

For cutting holes of irregular shape on the inside of a steel block, only one hole need be drilled through the block large enough to pass one end of a cut band saw through. Then the two ends of the band saw are welded together, after which the steel can be conveniently cut to the desired outline by merely feeding the work toward the saw along a previously scribed line. This method saves considerable time over the conventional method of drilling a row of holes close together along layout lines, hammering out the drilled "slug," and filing off the edges left by the drills. A self-contained electric welding device is provided for joining the two ends of the band saws after they have been passed through the block to be machined.

Inside filing can be done by uncoupling the file band at a point where a bayonet joint is provided, passing one end of the band through the hole to be filed, and then connecting the two ends of the band again. The file band consists of 3-inch file segments mounted on a flexible band of spring steel. The spring-steel band closely follows the curvature of the pulleys as it runs over them, but, of course, the file segments remain straight.

One of the important advantages of this machine is that the operation is continuous, as the filing and sawing are done in one direction only. The pressure of the cut is always downward, so that the tendency is to hold the work on the table. The machine is built in two models, the heavy-duty model shown in the illustration, and a lighter one.

Machine Designed for Filing and Sawing to Irregular Outlines



Greenerd Hydraulic Press Suitable for a Wide Range of Use

Greenerd Hydraulic Forcing, Broaching, and Molding Press

A self-contained hydraulic press, so controlled that pressures from 1/2 ton to 15 tons are obtainable on the down stroke and from 1/2 ton to 13 tons on the up stroke, is a recent development of the Greenerd Arbor Press Co., Nashua, N. H. This hydraulic press is unusually versatile in its applications, but it is particularly adaptable for assembly work, push or pull broaching, keyway cutting, and light plastic molding. In the last-named use, a heavy pressure can be employed on the down stroke, the mold can then be held under an even pressure until the plastic sets, and finally the mold can be opened with a 13-ton pull, if required.

The ram travels at the rate of 96 inches a minute under a 6-ton pressure, and at the rate of 36 inches a minute under a 15-ton pressure. The combination low- and high-pressure pump is driven by a three-horsepower motor on the side of the frame. A tank is located at the rear of the press. The control valve is either foot- or hand-operated. An automatic or manual reverse can be effected at any point, while a stop-rod regulates the length of travel in either direction. When the ram is in the top position, the pump by-passes and thus relieves all pressure.

Dings High-Intensity Magnetic Pulley

A magnetic pulley designed to obtain a high degree of magnetic intensity has been announced by the Dings Magnetic Separator Co., Milwaukee, Wis. These pulleys are intended for use as the head pulleys for conveyor belts where they remove tramp iron from material before it is crushed or pulverized in order to protect the crusher from damage and keep the product free from iron. The magnetic pulleys are also adapted for many other uses. When used in steel mills for conveying or propelling pipes and metal sheets, for example, the magnetic pulleys serve to increase the frictional driving contact.

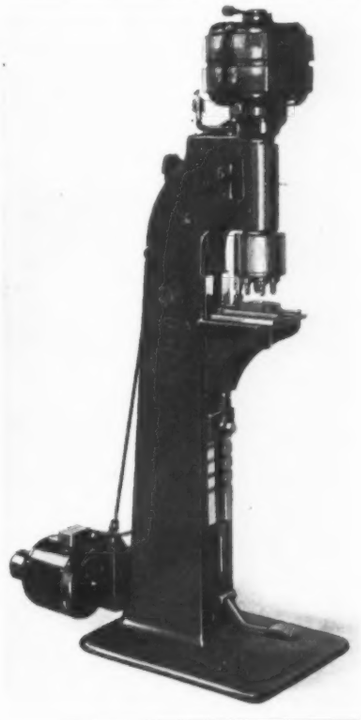
The magnetic pulley shaft is turned and polished. Each pulley is supplied with set collars, bronze collector rings with double contact brushes for each collector ring, dustproof collector ring housing, and steel switch cabinet containing a pilot lamp with bull's-eye indicator to show when current is flowing.

Grant Multiple-Spindle Rivet-Spinning Machine

Heads are simultaneously spun on four posts in a clock frame by employing a four-spindle head on the noiseless rivet-spinning machine here shown, which was recently developed by the Grant Mfg. & Machine Co., 90 Silliman Ave., Bridgeport, Conn. The four-spindle head is driven by a vertical direct-connected motor on top of the machine.

Mounted on the table of this machine is a fixture which slides out in front to facilitate assembly of the clock frame parts. The fixture, with the assembly in place, is then pushed back into position for riveting, after which the operator trips the foot-treadle. This automatically clamps the assembly and causes the riveting or spinning operation to be performed. The cycle of operations requires less than two seconds.

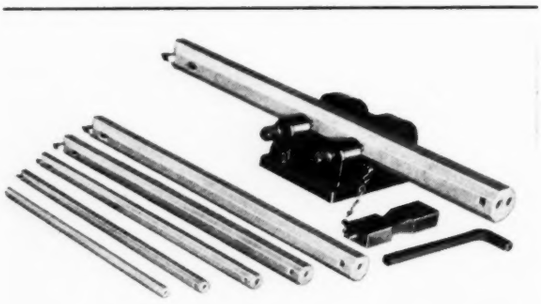
The horizontal motor at the rear of the machine furnishes power for actuating the automatic clamping mechanism and for bringing the spindle head down to perform the riveting operation. Heads can be built with any number of spindles from two to six, depending upon the diameter of the rivets to be spun and their center-to-center distances. Both motors of the machine are operated from one switch.



Machine which Spins Heads on Four Posts of a Part at One Time

Kershaw Rapid-Production Boring Tools

The boring-bars, cutters, and holder shown in the accompanying illustration have been developed by F. A. Kershaw, Kent, Ohio, for rapid-production boring on engine lathes. They have been designed to insure the rigidity required for accurate and high-speed operation and to permit rapid setting and resetting of the tool.



Kershaw Boring Tool Equipment for Engine Lathes

The holder is of gray iron and has a 90-degree groove which locates the boring-bars parallel with the spindle and at the proper height to permit using the maximum size bar for the diameter of the hole bored. A hardened liner is attached to the holder for use in clamping the smaller boring-bars.

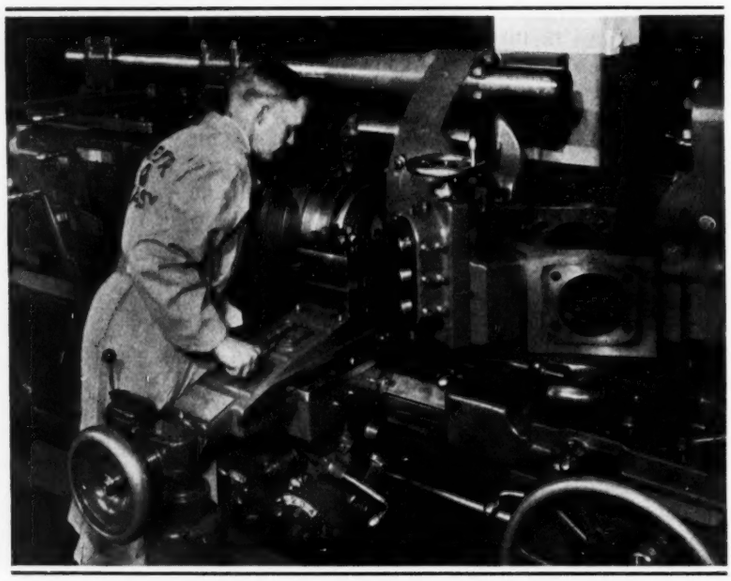
The boring-bars are made of crucible tool steel, such as is used for cold-chisels, drills, and similar tools. They are octagon in form, heat-treated, and drawn to 300 Brinell to give them maximum strength and rigidity. A hole is broached in each end of the bar to receive the cutting tools or bits. One hole is at an angle of 90 degrees for recessing, under-cutting, inside facing, or similar work. The hole at the opposite end is broached at an angle of 30 degrees to permit the end of the cutter to project beyond the end of the boring-bar for facing blind holes, counterbores, etc. This angle also facilitates grinding threading tools.

The boring-bars are made in six sizes ranging from 1/2 inch to 1 3/4 inches and from 12 to 24 inches in length. The smallest bar takes 3/16-inch cutters, and the largest bar 7/16-inch cutters.

Warner & Swasey Universal Turret Lathe

A new No. 4-A universal turret lathe built by the Warner & Swasey Co., Cleveland, Ohio, was referred to in September MACHINERY in connection with descriptions of new equipment at the Cleveland Exposition. The accompanying illustration shows the important features of this machine. It is available in 8- and 9-inch spindle capacities, with 28 1/4-inch swing. The spindle is mounted on Timken precision bearings at the spindle nose end, and on precision straight roller bearings at the rear.

A new cross-slide and square turret are provided with a square lock gib for the sake of rigidity. This construction is used in combination with the conventional dovetail on the opposite side of the cross-slide. It aids in absorbing the strain of overhanging tools and supports cuts taken by carbide cutters without vibration.



Warner & Swasey No. 4-A Universal Turret Lathe

The square turret, made from a solid forging, has an internal clamp ring, eliminating the tendency to looseness due to wear. The indexing clamp handle for the turret is located in front, where it does not interfere with the hexagon turret tools when indexing. As optional equipment, an open type square turret may be obtained for multiple tooling and the holding of long-shank forming tools. Shims are used to elevate the cutting tool to the correct height. This is essential when using carbide tools, to insure the correct cutting angle.

Both the hexagon turret-slide and the square turret carriage are equipped with an oil reservoir and a Bijur pump. A direct-reading indicator is provided in the head gear shift which enables the operator to readily pick the desired spindle speed. Rapid

traverse is offered as optional equipment for the cross-slide. The independent lead-screw is another important feature for threading operations. This is a solid lead-screw, independent of the feed-shaft. This lead-screw was referred to and illustrated in the September number of MACHINERY, page 46.

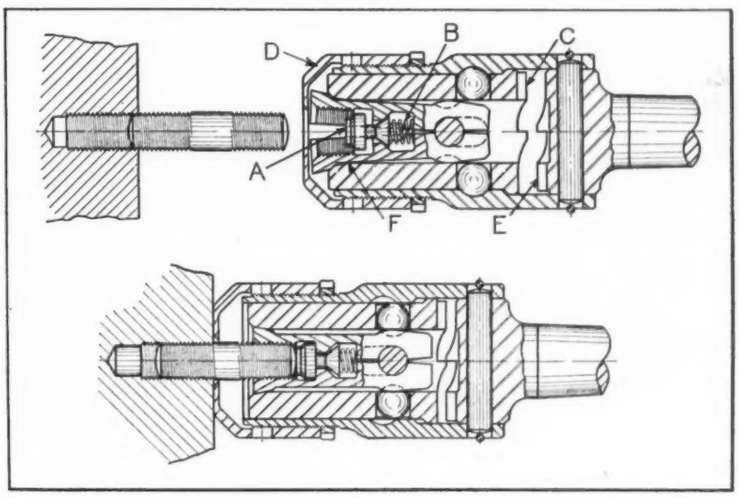
Modern Tool Works' Self-Opening Stud-Setters

A self-opening stud-setter, designed to operate automatically in any position without mutilating the thread when used in portable tools or drilling machines, has been added to the line of tools made by the Modern Tool Works Division of the Consolidated Machine Tool Corporation, Rochester, N. Y. This stud-setter is made in a 1/2-inch size having a capacity range for studs from 3/16 to 1/2 inch in diameter, and in a 7/8-inch size having a capacity range for studs from 9/16 to 7/8 inch in diameter.

The stud-setter operates so easily that it is possible to stop the drive at any point and open the jaws, which is especially advantageous in setting shoulder studs. A ball-locking device prevents the jaws from opening until the stud is set to the desired height.

In setting a stud with a closed-end stop-collar, the tool is guided centrally over the stud by means of a pilot hole in the stop-collar. The jaws remain open, as shown in the upper view of the illustration, until contact of the stud with stop *A* compresses spring *B* and brings the threads in the jaws into full register on the stud. At this point, the balls lock in the driving position, shown in the lower view. Further movement engages driving clutch *C* and the shank clutch *E*.

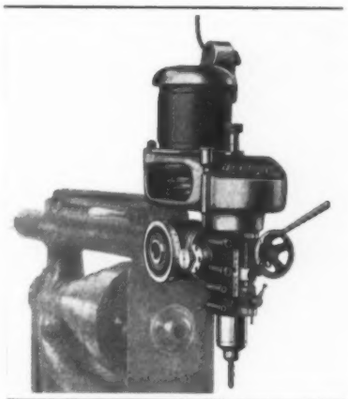
When the stud is set to within 1/8 inch of the height desired, stop-collar *D* comes in contact with the piece in which the stud is being set or a plate employed to govern the height of the stud. The shell of the stud-setter is then kept from moving forward, and the lead of the thread on the end of the stud disengages clutch *C*. The jaws remain engaged on the stud until they are opened by lifting the stud-setter.



Self-opening Stud-setter Brought out by the Modern Tool Works

High-Speed Milling, Drilling and Boring Attachment

A high-speed milling, drilling, and boring attachment, which is adaptable to all types of milling machines, including machines with a rectangular over-arm, has been added to the line of the Bridgeport Pattern & Model Works, 52 Remer St., Bridgeport, Conn. The illustration shows this attachment mounted on the front face of a standard dual adapter. When settings of compound angles are necessary, the attachment is mounted on the side face of the adapter.



High-speed Milling, Drilling, and Boring Attachment

Although this attachment was developed chiefly for die-sinking, jig and fixture work, and general tool-room use, it is also applicable to manufacturing jobs. Its main advantage is that milling, drilling, and boring can be performed at various angles without changing the set-up of the work. Spindle speeds from 275 to 4250 revolutions per minute are available.

The spindle is provided with a No. 2 Morse taper. The spindle quill has a travel of 3 1/2 inches. A micrometer depth stop is standard equipment. A motor of 1/3 horsepower drives this attachment.

Goggles with Improved Super-Safety Lenses

An improved wide-vision goggle for protecting the eyes during such operations as chipping has been announced by the Chicago Eye Shield Co., 2298 Warren Blvd., Chicago, Ill. A new type super-safety lens is used that does not change the direction of the light rays passing through the lens. The eye cups

are designed to allow natural, full, wide vision. The close fitting edges that are in contact with the face have a pure gum cushion binding. The curved lenses are interchangeable.

Racine "Oil-Cut" Metal-Cutting Machine

The principal feature of a 6- by 6-inch metal-cutting machine being introduced on the market by the Racine Tool & Machine Co., Racine, Wis., is a hydraulic feed and control. The hydraulic unit, which is complete in itself, comprises a simple piston pump, a single control lever, and two graduated dials which facilitate obtaining desired feeds and pressures. The entire unit is mounted as a sub-assembly. It can easily be removed when desired, as no piping or connections are employed. There is no leakage of oil, since the few exposed bearings are so arranged that oil coming from the bearings is drained back into the main reservoir.

This machine is equipped with a built-in three-speed transmission made up of hardened steel gears which are completely enclosed and run in oil. The saw frame is made with unusually broad bearing surfaces, and is so designed that the pressure of the blade tends to center the frame above the work. The flexible hydraulic feed automatically adjusts itself to suit the pressures built up against the blade, so that in cutting a round bar, the feed is faster at the beginning and end of the cut than it is when the saw is near the center of the work. The opposite condition occurs in cutting tubing. In cutting cold-rolled steels, from 3 to 4 square inches can be cut per minute, and it is mentioned that a 3-inch steel tube with 1/4-inch walls can be cut in forty seconds under production conditions.

The machine can be supplied with a belt drive or with a 1 1/2-horsepower motor drive, in which case the power is transmitted through two V-belts. The actual capacity of the saw is for 6- by 6-inch square bars or for 6 5/8-inch alloy bars with the vise positioned straight. When the vise is set at an angle of 45 degrees, 4 1/2-inch square bars can be cut.

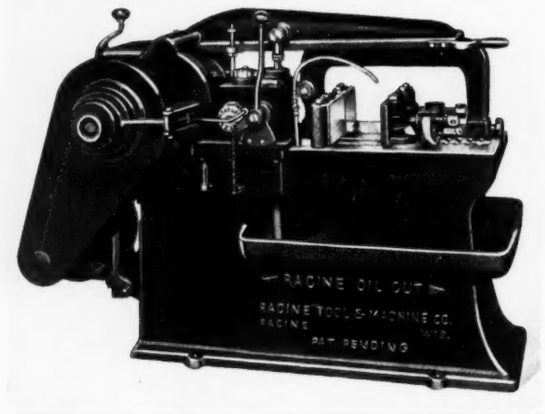
Roper Rotary Pumps for Lubricating Systems

A series of rotary pumps especially designed for steel mill lubricating systems, but which may be used for any application requiring pressures up to 100 pounds per square inch, has been added to the line of pumps and other hydraulic equipment made by the Geo. D. Roper Corporation, Rockford, Ill. These pumps, known as the 997 series, are regularly made in seven sizes covering a capacity range of 80 to 700 gallons per minute. The pressure ranges from 0 up to 100 pounds for lubricating liquids, and up to 40 pounds for non-lubricating liquids. Herringbone pumping gears, sleeve bearings, and packed stuffing-boxes are employed.

The pumps with standard fittings have all parts made of cast iron, except the steel driver pumping gear and shafts. The bronze fitted pumps have all parts made of cast iron, except the bronze pumping gears and the stainless-steel shafts. The all-bronze pumps have all parts made of bronze except the stainless steel shafts. These pumps can be obtained as complete units, as shown in the illustration, or the pump head can be purchased separately.

Waldron Cross Type Couplings

To meet the demand for an inexpensive flexible coupling for light-duty motor drives where misalignment of connected shafts is unavoidable, the John Waldron

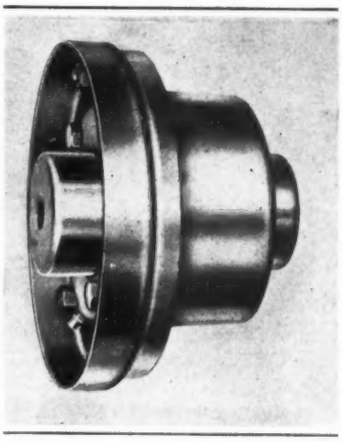


Racine Metal-cutting Machine with Hydraulic Feed and Control

Roper Rotary Pump Unit Designed for Lubricating Systems

Corporation, New Brunswick, N. J., has developed the coupling here illustrated. It is of the totally enclosed lubricated type and is dust- and moisture-proof. Each size has ample capacity to safely transmit the load of a motor whose shaft diameter is within the maximum bore of the coupling.

Alignment can be checked without disturbing the coupling, as the hole in the end of the grease cover is concentric with the hub when the connecting shafts are aligned. These couplings are available in four sizes, with maximum bores from 1 1/8 to 1 7/8 inches in diameter and with capacities for transmitting from 0.175 to 1 horsepower per 100 revolutions per minute up to a speed of 1800 revolutions per minute.



Waldron Flexible Coupling for Shafts Subject to Misalignment

Elwell-Parker Elevator Truck

A Type ELN-6 elevator truck of improved design having a capacity of 6000 pounds and driven by either electric or gas-electric power has been brought out by the Elwell-Parker Electric Co., Cleveland, Ohio. Certain advantages in construction and also in truck performance have been obtained by replacing the hoisting cable with chains.

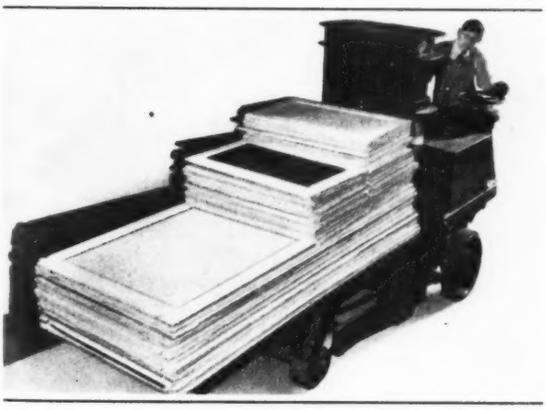
The operator stands on rubber pedal pads which absorb vibration when traveling over rough surfaces. Automatic cut-out switches stop the platform movement at both the upper and lower limits of travel. However, the platform can be manually stopped at any height and held there by a spring-actuated electro-mechanical brake. An interlocking control between the travel controller, drive motor, and foot-pedals serves to prevent accidents. The operator must be standing on the pedals before the truck can be moved.

Dynamic braking can be obtained for ramp operation if desired. With the telescoping uprights, the platform can be lifted 62 1/2 inches before the inner uprights begin to rise. Loaded skids can be tiered in box cars or other places having low headroom. In the warehouse or in the open, the loaded skid can be raised to a height of 10 feet or more. The truck itself is 41 inches wide and 128 inches long, with a platform 27 by 54 inches. When equipped with a die-pulling attachment, the truck can be used for placing dies in presses or removing them.

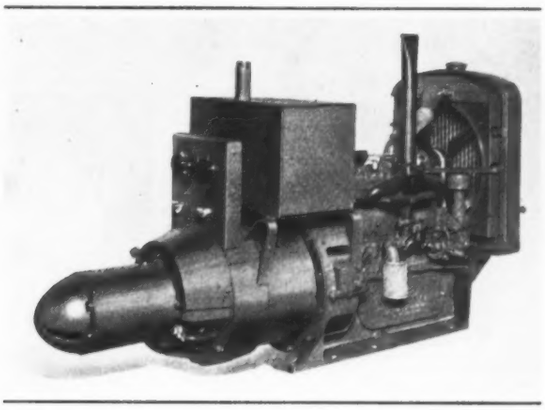
Lincoln Engine-Driven Welder

A 200-ampere engine-driven welder designed to meet the demand for a low-priced unit of this type has been announced by the Lincoln Electric Co., Cleveland, Ohio. This new model, known as the "200-ampere Shield Arc Special," supplies a uniform current for welding with bare or heavily coated shielded arc type electrodes in all sizes up to 1/4 inch. The welding current range of this new machine is from 60 to 250 amperes.

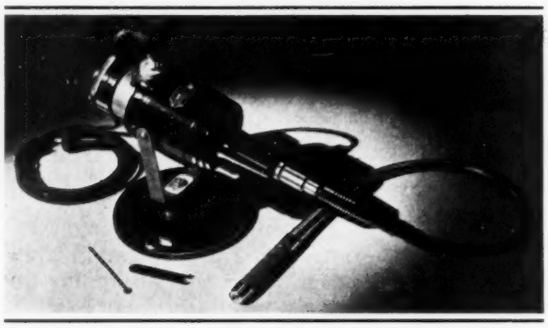
The welder is driven by a direct-connected Waukesha four-cylinder engine which delivers 23 horsepower at 1400 revolutions per minute, the speed at which the welder is operated. A gear-driven governor maintains proper speed at all load conditions. A gasoline tank of ample capacity to provide for a full day's operation is mounted over the generator. The weight of the complete welding unit is only 1078 pounds.



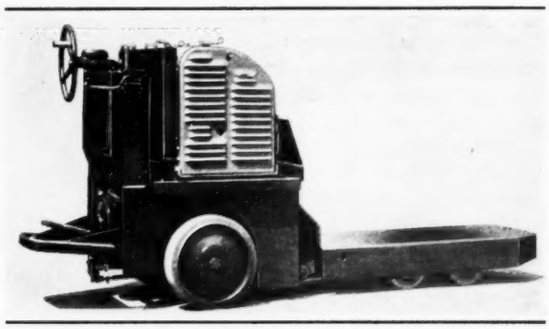
Elwell-Parker Elevator Truck of Improved Design



Lincoln 200-ampere Engine-driven Shield Arc Welder



Dumore Flexible-shaft Tool with Electrical Speed Governor



Mercury Industrial Truck with Hydraulic Elevating Means

Dumore Vari-Speed Flexible-Shaft Tool

Speeds from 1700 to 12,000 revolutions per minute are obtainable with the twist of a wrist on a KG vari-speed flexible-shaft tool being introduced to the trade by the Dumore Co., Racine, Wis. Thus burring tools, rotary files, grinding wheels, and cutters can be driven at just the right speed for efficient use on metal, wood, or composition materials.

The range of speed is made available through an electrical governor which works somewhat on the principle of a steam governor. Alternating current only can be used with this tool, although a 1/4-horsepower universal motor is furnished. Condensers and resisters are incorporated in the housing of the motor itself.

The unit can be mounted on a base, as shown, or suspended from a bail. The flexible shaft is 43 inches long and is equipped with a ball-bearing hand-piece. A telescopic feature prevents the shaft from touching the sheath.

Mercury Heavy-Duty Electric Truck

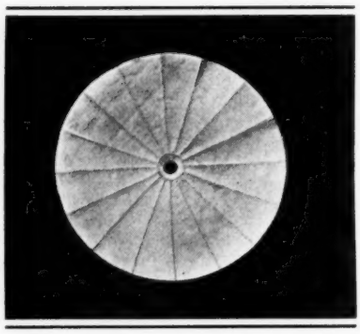
A low-lift industrial truck with a capacity of 10,000 pounds has recently been designed by the Mercury Mfg. Co., 4100 S. Halsted St., Chicago, Ill. The platform of this truck is elevated by means of a hydraulically operated link mechanism.

Other features of the truck include a tandem trailing axle equipped with four wheels, brakes located in the drive wheels, a magnetic contactor control of traveling and hoisting, and an automatic overload protection. The steering wheel may be mounted horizontally or vertically.

The illustration shows a truck equipped with a gasoline-electric unit for continuous operation, but the truck is regularly built with a compartment for the cells necessary in storage-battery operation.

Humidified Buffing and Polishing Wheels

A new line of buffing and polishing wheels made of cloth that is given a special treatment before being made up into buffing wheel sections has been added to the line of plating equipment and supplies made by the Udylite Co., 1651 E. Grand Blvd., Detroit, Mich. The treatment of the cloth, known as the Udylite humidifying process, introduces the proper moisture content into the fibers of the cloth to give it maximum tensile strength and wear resisting qualities. This process is used in making buffing wheels of all sizes, types, and styles of sewing.



Udylite Humidified Buffing and Polishing Wheel

It has been found that cloth, when allowed to dry out or become deficient in moisture content, is weakened and is unlikely to resist wear as well as cloth in perfect condition. To make certain that the new buffs are properly conditioned to provide maximum service, every piece of cloth entering into their construction is given the humidifying treatment. The buffs are packed or sealed in moisture-proof paper to insure maintaining this condition.

Black & Decker ½-Inch Junior Drill

The 1/2-inch Junior portable electric drill recently added to the line of the Black & Decker Mfg. Co., Towson, Md., is intended for all-around use. It can be employed for operations on any metal or wood, and will drive a variety of accessories. The low spindle speed of this tool adapts it for cutting clean round holes with a hole saw.

Holes up to 1/2 inch in diameter can be drilled in steel, and wood augers up to 1 1/4 inches can be driven. The universal motor operates on either alternating or direct current. It is intended for current of 110

Drill of 1/2 Inch Size, Added to the Black & Decker Line

volts, but a motor can be supplied for current of 32, 220, or 250 volts. Compo oilless bearings, a safety switch, a three-jaw chuck, a spade handle, and an auxiliary pipe handle are standard equipment. This drill weighs 10 1/2 pounds.

Federal Clear-Vision Indicator

A Model 95 indicator of the "Clear Vision" type has just been brought out by the Federal Products Corporation, 1144 Eddy St., Providence, R. I. This indicator is designed to show clearly variations of 0.0001 inch. As the graduations are 1/5 inch apart, 0.00005-inch measurements can be easily determined.

This indicator is similar to the Model 866 described on page 46 of September MACHINERY, but is of larger size. While adapted for use in laboratory work because of its great accuracy, it is also suited for shop use, either on production or inspection work.

Federal Indicator with 0.0001-inch Graduations, 1/5 Inch Apart

Illuminator for Microscopic Examination

Difficulty in lighting opaque specimens by means of lights placed above or to one side of a microscope has been overcome by a surface illuminator brought out by the Bausch & Lomb Optical Co., Rochester, N. Y. This equipment provides for illuminating either opaque or translucent specimens when examining them at low magnifications with a laboratory microscope or a toolmaker's microscope.

Surface Illuminator for Use on Microscope, with Transformer and Variable Resistance

The illuminator, which is shown in the lower right-hand corner of the illustration, consists of an annular ring holding six 2.5-volt, 0.3-ampere electric bulbs, equally spaced around the inside of the ring. There is an individual reflecting surface back of each bulb. The ring slips on over the microscope objective and is held in position by an extension rod suspended from a clamp on the eye-piece adapter.

The transformer with variable resistance and switch, shown to the left of the illustration, is supplied with the illuminator and provides a means of dimming the light as desired.

Diehl Bench Grinder Designed to Provide Work Clearance

Diehl Electric Bench Grinder

A bench grinder having a motor housing with the front face flat, so that long pieces can be ground without interference, is being placed on the market by the Diehl Mfg. Co., Elizabethport, N. J. This grinder is portable, although it is provided with a heavy cast-iron base that eliminates the need of fastening the grinder to a bench or table. Rubber-insulated feet minimize the noise and vibration of grinding.

Steel wheel guards of an adjustable design are provided. The tool-rests are also adjustable to compensate for wheel wear and for setting in any grinding position. Two grinding wheels, 6 inches in diameter by 3/4 inch in thickness, one of coarse grain and the other of fine grain, are standard equipment. The motor is totally enclosed and rated at 1/4 horsepower. It has a speed of 3450 revolutions per minute.

Shaft attachments can be supplied for drilling, sanding, and buffing operations. They include a work-arbor with a drill chuck on which a sanding drum, sanding disk, cotton buffing wheel, or wire scratch wheel can be mounted.

Udylite Ball Anodes for Plating

Ball type anodes are now being made for copper, brass, and zinc plating by the Udylite Co., 1651 E. Grand Blvd., Detroit, Mich. Some of the advantages

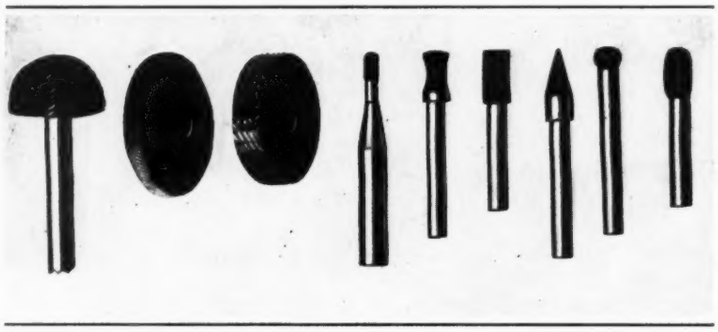


Fig. 1. Various Styles of Hand-cut Rotary Files Made of High-carbon and High-speed Steels

claimed for the ball type anodes are that they maintain constant anode area, eliminate scrap losses, provide a convenient method of adding anode material, and require less anode metal to obtain a given area.

Hand- and Mill-Cut Rotary Files

Hand-cut rotary files of many new shapes have recently been made by the Rotary File Co., 426 Wilcoxson Ave., Stratford, Conn. Fig. 1 shows typical shapes intended for a large variety of applications. Some of these files are made of high-carbon steel and others of high-speed steel. The high-carbon steel files are generally recommended for mild steel, aluminum, soft brass, copper, leather, and wood, whereas the high-speed steel files are for use on die steels, iron, etc.

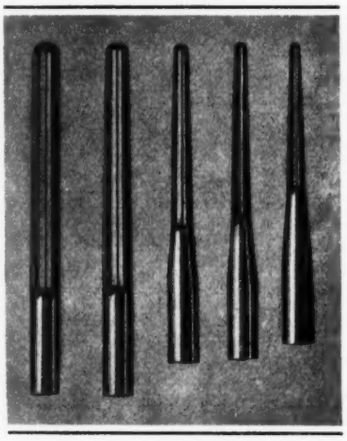


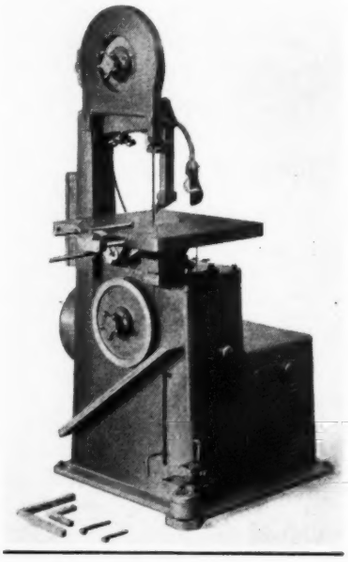
Fig. 2. Mill-cut Rotary Files for Cleaning out Deep Recesses

Fig. 2 shows several mill-cut rotary files intended for use in cleaning out deep narrow recesses in aluminum, brass, silver, etc. One typical use is the finishing of the walls and bottom of fins on airplane cylinder-head castings. The largest mill-cut file shown tapers from 0.220 inch at the small end to 1/4 inch at the large end, while the smallest tapers from 0.075 to 0.140 inch.

Precision Band Saw with Filing Attachment

A precision band saw with a filing attachment for use in finishing die openings and similar work has been brought out by Neff Kohlbusch & Bissell, Inc., 2400 W. Madison St., Chicago, Ill. This band saw is particularly adapted for such work as machining the opening in a die, stripper, and punch pad in one operation with these three members assembled. When this method is used, the three members, after being machined, are doweled together with the die at the top. The radius holes and other holes are then drilled, reamed, or bored through the three pieces. Next the unit is taken to the band sawing machine, where the saw is put through one of the radius holes and brazed together, after which the opening is sawed out. The saw is then broken apart and the filing chain inserted. The three pieces are now rough-filed on the machine within 0.004 to 0.005 inch of the line. Then the punch pad is removed, and the die, with the stripper on the bottom, is finish-filed. Next, the clearance is filed in the die and stripper, after which the punch is laid out and band-sawed within 0.008 to 0.010 inch of the line. The saw is now removed and the filing attachment assembled for finishing the punch. The remainder of the process conforms with usual practice.

The band saw consists of two main parts, a box column which houses the motor drive, blower, feed weights, etc., and the band saw unit, comprising the work-



Neff Kohlbusch & Bissell Precision Band Saw

table, saw drums, and drive members. This drive is taken by step cones through a worm and worm-gear to the lower saw drum. The worm and worm-gear run in oil. The saws range in widths from 1/8 to 3/8 inch; they are cut in suitable lengths from standard coils and joined by brazing. An arrangement for automatically feeding the work to the saw is incorporated in the machine.

Provision is made for tilting the table 10 degrees in four directions. The table is 22 by 22 inches, and will take material up to 8 inches in thickness. The dis-